PHOTOGRAPHY MADE EASY.

505958

PHOTOGRAPHY MADE EASY.

BY

R. CHILD BAYLEY,

Author of "The Complete Photographer," "Hand Cameras,"
"Photographic Enlarging," etc. Honorary Fellow of the Royal
Photographic Society.

[*Third Edition: Revised Throughout*]

ILIFFE & SONS LIMITED
DORSET HOUSE, TUDOR STREET, LONDON, E.C.4

MADE AND PRINTED IN ENGLAND
AT
THE CHAPEL RIVER PRESS, ANDOVER, HANTS

PREFACE TO THE THIRD EDITION

FOR nearly a quarter of a century one of my daily duties was to receive enquiries from amateur photographers, the great majority of them beginners, each morning's post bringing from half a dozen upwards. No one could have such an experience without learning what it is which the novice wishes to know, or ought to know. In writing this book, the questions put to me have been constantly in mind, and I have endeavoured to provide answers to them, or, what may be more useful, to put the enquirer on the road to answer them for himself. If the directions in some cases seem needlessly explicit, I ask any reader who is impatient to believe that there are would-be photographers who have found less detailed information insufficient. Mere verbiage I hate as much as anyone ; but I have learnt that brevity may be bought at the expense of clearness, and that it is very difficult to write even as little as a single sentence of practical instruction in photography so that anyone with no previous knowledge of the subject may understand it fully.

When I came to revise the book for this edition, which has been reset throughout, I was surprised to find how very little alteration was needed to bring it up to date, progress in recent years having been mainly in the direction of improvements in camera design and in the quality of plates, films and papers. The amateur photograper to-day, when he does his photography himself instead of leaving it to the dealer, does it very much as the amateur photographer in pre-war times did it. The advanced worker has new processes at his disposal, but these lie outside my scope here.

It only remains to add that while this book was based upon the " Lessons for Beginners " which are a regular feature of *The Amateur Photographer,* they are not a reprint of any of them.

R. C. B.

CONTENTS

PAGE

I.—INTRODUCTORY 1

II.—PLATES AND FILMS 5

III.—HOW A LENS WORKS 10

IV.—HOW A LENS WORKS (*continued*) . . . 21

V.—KINDS OF LENSES 36

VI.—THE CAMERA 42

VII.—APPARATUS AND MATERIALS 49

VIII.—TYPES OF PLATES 55

IX.—LOADING THE CAMERA 61

X.—FIXED-FOCUS CAMERAS 66

XI.—FOCUSSING 76

XII.—ARRANGEMENT OF THE SUBJECT . . . 86

XIII.—THE EXPOSURE PROBLEM 93

XIV.—DEVELOPING THE NEGATIVE 104

XV.—PRINTING ON GASLIGHT PAPER . . . 120

XVI.—PRINTING ON SELF-TONING PAPER . . . 137

XVII.—TRIMMING AND MOUNTING 142

XVIII.—PREPARING NEGATIVES FOR PRINTING . . 155

XIX.—PRINTING DEFECTIVE NEGATIVES . . . 165

XX.—MAKING UP A DEVELOPER 171

XXI.—SULPHIDE TONING 174

XXII.—HOME PORTRAITURE. 179

PAGE
XXIII.—Copying 189
XXIV.—Landscapes 195
XXV.—Indoor Subjects 200
XXVI.—Holiday Photography 203
XXVII.—Hot Weather Troubles . . . 209
XXVIII.—Enlarging 215
XXIX.—Making Lantern Slides. . . . 225
XXX.—The Care of Apparatus and Materials 233
XXXI.—Cleanliness 239
XXXII.—What not to do 242

PHOTOGRAPHY MADE EASY

CHAPTER I

Introductory

THE PHOTOGRAPHIC PROCESS IN OUTLINE—SENSITIVE MATERIALS USED—NEGATIVES AND POSITIVES—MAKING PRINTS BY CONTACT AND BY ENLARGING.

A PHOTOGRAPH is made by exposing, in a camera, a plate or film to the image of the object which is formed on the light-sensitive surface of that plate or film by the lens. This exposure does not make any visible change in that sensitive surface, but forms an invisible or latent image, which is made visible by a process called development. The stages of making a photograph are seven in number: (1) the choice and arrangement of the subject; (2) "focussing" the image, in order that it may be clear and distinct; (3) the exposure; (4) the development; (5) fixing, by which the sensitive substance is made no longer alterable by light; (6) washing, by which we get rid of the remains of the chemicals used in development and fixing and other by-products; and (7) drying. The result of these processes is what is called a "negative," from which a "print" or "positive" is made by what is, with certain modifications, a repetition of the processes, at least as far as stages 3 (sometimes 4), 5, 6, and 7 are concerned. A print or positive, strictly speaking, is a negative of the first negative.

We will consider these points in a little more detail. The chief sensitive substance used in negative-making is a compound of the metal silver with the liquid element bromine. There are other compounds of silver present in small quantities, but mainly we depend on silver and bromine, forming a compound known as " silver bromide." This, the light-sensitive substance, is mixed with gelatine to form an " emulsion." The gelatine acts as a vehicle to hold the silver bromide in place throughout the operations ; otherwise, being a powder, it would wash away and the image would be disintegrated. The gelatine also makes the silver bromide more sensitive to light.

The emulsion is spread or coated upon some support, to allow of handling it, and this support may be glass, sheet celluloid, or paper. If it is glass, the layer of emulsion on it makes it a " plate " or a " dry plate " ; if it is celluloid, it is a " film "—a cut film or a roll film, as the case may be ; if it is paper, the product is either negative paper, bromide paper, gaslight paper, or printing-out paper (P.O.P.). For negative making, either plates or films are used ; very occasionally negatives are made on paper. Whether the photographer uses glass plates or celluloid films, the processes are the same. A glass plate is rigid, while a celluloid film is flexible and can be rolled, and from this there follow little differences, as, for example, a plate can be stood up to dry, while a film is pinned up ; but in the main the treatment of plates and of films is identical. Moreover, there is no " best " in the case of the choice between films and plates—either will give perfect results when properly used.

Partly in order to reduce confusion to a minimum, partly from habit—as plates preceded celluloid films—it is customary to speak of " plates," when " plates or films " would be more strictly correct. In this book, therefore, the sensitive surface in the camera will be constantly referred to as " the plate " ; and, unless it is quite evident that plates, and not films also, are meant, it must be understood that the reference is to both.

Plate and film-making is a large industry, which requires a great deal of technical knowledge and skill, and very special appliances, so that it is not possible for the beginner to make his own emulsion and coat it. The sensitive emulsion is made and coated by a very dim red light of a special character, as this light has comparatively slight action upon the product. The plates or films are dried in the dark and then are packed so that no light whatever can reach them, and in this condition are on sale. They must be put into and taken out of the camera, developed, and placed in the fixing bath without exposure to any light whatever, except such a " safe " light as we have referred to, and even to that the exposure must be as little as possible. The only exception, when ordinary light reaches the plate, is just at the moment when the image formed by the lens falls on the plate, which is called the " exposure."

A " negative " is the name given to a photograph which is a faithful reproduction of the original subject, in light and shade, but reversed. This reversal is twofold. It affects the light and shade, and it affects the relative position of the parts of the subject. A black and a white object lying on a grey ground appear with the ground grey in the negative, but the black object appears white, and the white one black. Portraits of white people in black clothes come out with black faces and light garments. The picture is also reversed right for left. A negative of this word " OUT " as it appears here, printed in black ink on white paper, would show the letters as white ones on a black ground, while they would be arranged thus, " TUO."

These differences are what constitute a " negative," and not, as the non-photographic public generally seems to believe, the fact that the photograph is on glass. A negative may be on glass, or on celluloid film, or on paper ; it is still a negative if the image is reversed as regards light and shade. As regards reversal of right for left, one cannot always be so certain, since negatives are necessarily transparent, and if we look through them from the back they no longer appear reversed in this aspect. Then, again, there are " positives " on glass or on celluloid, as well as on paper. A lantern slide is such a " positive." As it is on glass, non-photographers are apt to think it is a negative ; but the light and shade of the original is not reversed in a lantern-slide, as it would be in a negative, but is exactly correspondent to the light and shade of the original subject.

Whether we make a print in the usual way, which is called " by contact," or whether we make it by photographing the negative in a camera, which is done when we wish to alter the size of the picture as in enlarging, the result in every case is a fresh negative of the original negative. In this fresh negative the light and shade are reversed again; what was black in the original negative now appears as white, and what was white, black. So that in this new " negative " the double reversal gives us what we want, namely, an image in which the parts which were light in the original subject are light in the photograph, and the dark parts dark. We therefore no longer speak of it as a negative, but as a " positive," referring back in so doing, beyond the intermediate negative to the original subject.

To avoid any misconception, therefore, we must be careful to remember that the essential feature of a negative is not that it is on glass, but that the light and shade are reversed.

CHAPTER II

Plates and Films

THE RELATIVE ADVANTAGES OF PLATES AND FILMS CONSIDERED—THE CHOICE OF A SIZE—STANDARD SIZES—THE QUESTION OF COST.

ONE of the first questions which the purchaser of a photographic outfit has to settle is whether he will use plates or films. It will be well to see what are the advantages and disadvantages of each.

Films can be obtained in three different forms : (1) Roll-film, supplied in lengths, rolled with opaque paper on a spool forming a " daylight-loading cartridge," which, as its name indicates, can be put into and taken out of the camera without having recourse to a dark room ; (2) film packs, in which a dozen flat films are held in an appliance, which also allows them to be inserted in the camera and the whole pack after exposure to be changed for a fresh one without a dark room ; (3) cut films, in which the celluloid base is stout enough for the film to be handled very much as a glass plate is handled.

Roll-film requires a special type of camera for its use ; for, although there are roll holders to fit on plate cameras, they are open to certain objections, and are seldom seen. Film packs require an " adapter," which sometimes forms part of the camera itself, but more often is a separate attachment fitted to a plate camera. Cut films are used in the dark slides or sheaths used for glass plates, but generally require backing up with a piece of stiff cardboard.

Many roll-film cameras can be fitted, at a small extra cost, with an arrangement for taking glass plates ; but they remain essentially film cameras. The greatest objection to a roll-film camera is that in almost every pattern, so long as roll-film is being used, the subject has to be arranged in a finder, and focussed by means of a scale. This is no great matter, so long as snap-shotting is practised, as we shall see; but for the many subjects for which time exposures are given, it is a great help to have a ground-glass focussing screen, on which the picture can be seen and deliberately arranged and focussed. To do this—except with a reflex, or with one pattern of roll-film camera which was specially designed for the purpose—one must use plates, cut films, or the film pack.

The advocate of plates claims that they can be bought in a wide variety of make, of sensitiveness, and of other characteristics; that glass, in certain respects, is less liable to damage than celluloid; that plates can be kept without deterioration for a longer time before and after exposure; and that the rigidity and the substance of a glass plate make it more easily handled in the various operations. He points also to the advantage of being able to use a focussing screen, as already mentioned.

On behalf of roll-film it may be contended that the choice of makes is no real advantage, provided, as must be admitted, there are several good makes of roll-film available, which have highly sensitive, "orthochromatic" (a term to be explained subsequently) emulsions, as good in every way as on the best plates. Celluloid may be more easily scratched than glass, and a wet film negative may be rather floppy as compared with a plate; but the film is much lighter. It is free from all risk of breakage, unlike glass, which is one of the most brittle of everyday materials. As far as keeping properties are concerned, both plates and films will keep in perfect condition for years—far longer than anyone ought to think of keeping them—so that an advantage claimed for the plate in this respect is virtually non-existent.

Finally, there is a very great convenience to the tourist that, with roll-film, he is quite independent of a dark room, not only for loading and unloading his camera, but even for developing, as with a developing machine the film can be turned into finished negatives in full daylight.

Such are the principal arguments on one side and the other. There are minor differences, but these we need not trouble about at the moment. The reader can weigh up the considerations as they apply to his own case. Without intending to influence him one way or the other, we may point out that the principal advantages of roll-film are experienced by tourists. For work at home the comparative disadvantages of the plate vanish. We may add that, apart from variations due to the nature of the support of the emulsion, the treatment of plates and films is the same. Experience gained with one is helpful in the use of the other; the solutions used for both are similar in character, and the visible effects during the different operations are the same. When the negatives have been made, printing and enlarging can be carried out as well with one type of negative as with the other. Film negatives take up much less storage room, and can be sent through the post without packing. Both kinds are equally permanent.

When it comes to what may be called the running costs, these will vary according to the particular kind of sensitive material used, apart from the actual size. The cheapest form of material is either plates or cut films, the prices of these, size for size, being generally the same. Roll-film is considerably more expensive—in most cases being about double the price; but small sizes, up to 3¼ × 2¼ in. are an exception, as spools of eight exposures are now supplied at the price formerly charged for six exposures, making the cost of these films not much more than that of plates. The most expensive form of sensitive material is the film pack, which none the less is extremely popular. Panchromatic plates and films, which are not beginners' material, also cost more.

The beginner not only has to decide whether he will use plates or films, he has to settle on the size he proposes to work. There are various standard sizes, the materials for which can be obtained almost everywhere: and it is important to select one of these in preference to some little-used size, for which an outfit can be obtained second-hand at some tempting figure, the apparent cheapness being due precisely to the fact that it is an "odd size."

In plates alone there are a host of sizes; and the attempt made some years ago by the British Photographic Manufacturers' Association to reduce the number to less than a dozen, to be known by a series of numbers, did not meet with success.

For plates and cut films the most generally used sizes have been the following : $2\frac{5}{16}$ × 1¾ in. (6 × 4.5 centimetres), 3½ × 2½ in., 4¼ × 3¼ in. (quarter-plate), 5 × 4 in., 5½ × 3½ in. (postcard size for plates and cut films only), and 6½ × 4¾ in. (half-plate).

For roll films we have 2¼ × 2¼ in., 3¼ × 2¼ in., 4¼ × 2 ½ in., 4¼ × 3¼ in. (quarter-plate), 5 × 4 in., 5½ × 3¼ in. (postcard size for roll-film only). There are also one or two other sizes associated with special cameras. The continued tendency towards smaller and smaller negatives has resulted in cameras designed to use strips of standard or of sub-standard (16 mm. wide) cinematograph film ; while two exposures are now made instead of one on films originally designed for negatives 1⅝ × 2½ in. (4 by 6.5 centimetres).

In determining the size to use, the photographer will be influenced chiefly by the degree of portability which he wishes his outfit to possess. Within reason, any size not less than 3¼ × 2¼ in. will provide enlargements of suitable size for wall decoration, say, 12 × 10 in., or larger, provided the original negatives are good ones.

As just remarked, in recent years there has been a great increase in the use of cameras taking very small sizes indeed. They offer advantages in ease of focussing, and in some cases in the use of spools of film containing material for many exposures. So long as we do not require enlargements much above half-plate size they are very serviceable ; but the size of the particles of silver forming the image causes enlargements greater than this to look coarse and granular ; whereas with negatives of quarter-plate size there is practically no limitation to the size to which they can be enlarged.

Although, naturally enough, the materials for the larger sizes cost more than they do for the smaller ones, the cost is far from being proportional. The smaller the size, the greater is the cost of an equal area of plates, films, and paper. In the very small sizes, one is really paying for cutting, handling and wrapping more than for the material which is enclosed. Again, the smaller the size of the original negatives the more likely is the photographer to have recourse to enlarging. So that, all things considered, so long as we keep within the scope of the sizes which have been mentioned in the list just given, the cost of the materials is less likely to be a governing factor.

The apparatus costs more in the larger sizes, so far as the different sizes of the same pattern are concerned. But even in this respect there is not much economy in getting a very small camera ; as if we are to get negatives with it which will bear enlarging, and are not, in that respect, to have a high proportion of failures, we must have a well-designed and well-made instrument, one which is capable of working with greater accuracy and nicety than would be necessary if we were using a larger size.

Quarter-plate is, in my opinion, the best size for the beginner ; and, unless the reader has some special reason of his own for choosing another, that is the size I recommend him to obtain. His prints will then be large enough to satisfy him, in all but exceptional cases, without enlarging ; he will be working on a scale big enough to allow him to see what he is about ; and he will be able to count upon getting material in fresh condition wherever material is obtainable at all. If he prefers a smaller size than quarter-plate, then 3½ × 2½ in. for plates or for films 3¼ × 2¼ in. may be recommended.

CHAPTER III

How a Lens Works

Pictures with Pinholes—How the Pinhole Image and the Lens Image Resemble Each Other—Where they Differ—Why Focussing is Necessary.

ALTHOUGH to the great majority of amateur photographers there seems to be some mystery about the method in which the lens works, while no part of the outfit is the subject of so many misconceptions and fallacious notions, there should be very little difficulty in understanding the broad principles of lens action, and when this has been done, in applying the knowledge so gained to practical use. It will be helpful to an easy understanding of the subject if the simple experiments to be mentioned are actually made. There are a great many people, for example, who have never seen a pinhole image—that is, to recognize it; although everyone must have seen many.

It will help us if for the time being we regard the image which we obtain in our camera not as "formed" but "isolated." Let us suppose that a couple of candles a few inches apart are burning in an otherwise dark room, and that some two or three feet from those candles we hold up a sheet of white card, so that every part of one side of the card is receiving light from the two candles. It may appear startling to say so, but the card is covered with "images" of the candles, and the only reason why we cannot see them is that there are too many of them.

If we hold up between the candles and the card another sheet of card with a small hole in it, we shall by so doing cut off a great many of the images, and on the original card we shall see only two spots of light, each spot deriving from one candle flame. If the flames were bright enough and the hole small enough, we should be able to see on the card, not merely two light patches, but two distinct images, showing the form of the wicks of the candle, the dark and glowing envelopes of the flames surrounding them, and the tops of the candles themselves.

It is not easy to see this with candles; but if we make a small hole in the shutter of a darkened room, and, during the daytime, hold a piece of white card a foot or so away from the hole, it will be quite easy to see an image of the scene outside the window. To succeed, the hole should not be larger than will take the average pin (without its head), and must be in some thin substance, preferably a piece of thin metal, and must have no burr. Such a piece of metal may be placed over a larger hole in the wooden shutter.

One peculiarity of these images will be noticed at once: they are reversed right for left, and top for bottom. If candles are used, and the hole in the card is a large one, no one is likely to be surprised at this; since it is obvious that the light from the one candle, travelling in a straight line through the aperture to the white card or screen, and that from the other candle doing the same, these two streams or beams of light must cross at the opening in the card. One would rightly be surprised to find the light, when it got to the hole in the card, turning out of its straight path to fall somewhere else.

Yet I have often been asked how it is that the image on the focussing-screen of a camera is "the wrong way round." The reason is that it is precisely on all fours with the image formed by the two flames, and, that being so, this reversal is plainly inevitable.

We must be very careful to realize that nothing takes place (or nothing that need concern us) at the hole in the card which did not take place in that particular point of space before the card was put there. It is not the hole in the card which forms the image then, it existed before the second card was set up; it is that part of the card where there is no hole, which, by cutting off the light which otherwise would go to form innumerable other images, enables us to see the one image with which, thanks to the hole, the card does not interfere.

In the case of the candles, we have what is a direct source of light. Most natural objects are not themselves direct sources of light; but when they are illuminated they reflect some of the light, becoming indirect sources of light by doing so, and thus are able to form images in the same way as is done by the candle flames.

When, therefore, the lover claims that his mistress's image is on his heart, he is merely stating what is a prosaic fact, so long as she is present before him, and there is any light about; or, if her image is not on his heart, it is at least on that part of his waistcoat which covers his heart. It may not sound quite so romantic; but her image is equally upon the knees of his trousers and the tip of his nose. In fact, he is so effectively smothered in her images that it needs some pinhole (or lens) to make one of them visible by doing away with the rest.

In this view of the subject, we arrive at the rather startling conclusion that the image on the focussing screen, or on the plate or film, must be formed by the camera and not by the lens. This is true enough, however unexpected; but it will not do to push the conclusion too far.

Pinhole images are seldom used in photography, but they are perfectly practicable; in fact some very effective landscape pictures, which did not in the least suggest that they were made with merely a hole and not a lens at all, have been produced in this way and exhibited. Anyone can try the experiment for himself, by removing the glass of his lens, and placing over the mount a cardboard cap in the centre of which is a hole about a quarter of an inch in diameter. Over this hole is gummed a little disc of thin black needle-paper, and in the middle of this a fine hole is bored with the point of a needle made red hot. If the camera is opened out to about its usual extension, put on a stand and turned towards some object which is motionless, an exposure of about half an hour or so on a well-lit outdoor view will give a negative with very fair definition.

Two peculiarities will be noticed in connection with the pinhole image. One of these is that, within very wide limits indeed, there is no focussing necessary. We can have the plate or film a couple of inches or a couple of feet from the pinhole; the pictures will be equally sharp. The other is that, compared with a lens, a pinhole needs an exceedingly long exposure. It is this, in fact, primarily, which necessitates the use of a lens. If pinholes could be made which would work with exposures as short as can be used with lenses, a great many photographers would be quite content with a pinhole and would let the lens alone.

The cause of the length of the exposure is simply that the pinhole being very small, comparatively little light can get through it. We cannot remedy this by the simple plan of using a larger pinhole, because, although this certainly lets in more light, the image at once becomes less distinct. Yet it is quite evident that unless we can manage to do with a larger hole, somehow or other, we shall never be able to shorten the exposures.

Looking at fig. 1 for a moment, we see the simple image of a candle-flame formed by a single pinhole. As two holes (of equal size) may be expected to pass twice as much light as one, let us try the effect of a second pinhole above the first. It is easily drawn, as the light, we know, travels in straight lines (fig. 2). Evidently the second hole will not help us, as the image it forms, instead of falling on the same place on the screen as the first, falls above it. We merely get two images instead of one.

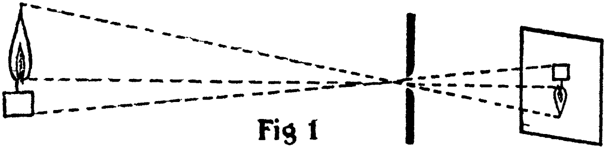


Fig 1

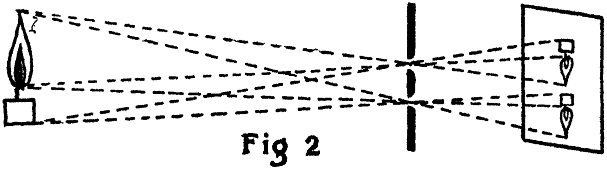


Fig 2

But now let us suppose that we place over the second hole a glass prism (A, fig. 3) of such a shape that it diverts the light reaching it through the hole, and causes the rays to bend downwards a little. We shall find that by such a device we can get the two images to coincide; and when we do that we should expect to get, and should get, an image twice as bright as we got with one of the holes only.

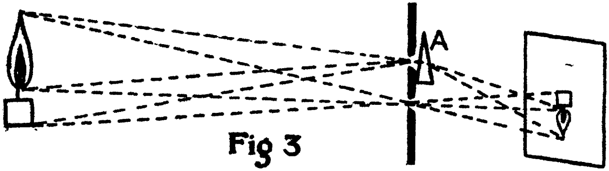


Fig 3

There is no need to limit ourselves to two holes; in fig. 4 we have a central hole with two holes above and two below it, and it is plain that we could surround the central hole with ring after ring of holes, if we could fit prisms over these holes so that the image formed by each hole fell on the same place on the screen. The prisms might take approximately the shape shown in fig. 4, and from the forms in fig. 4 to those in the left-hand diagram in fig. 5 is but a step. The more we have of such prisms in a given area, the more the

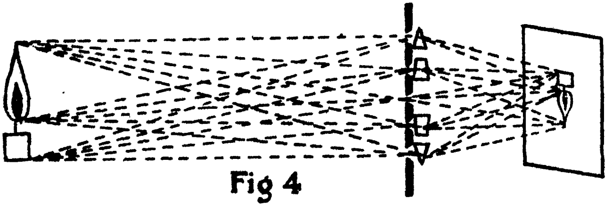


Fig 4

section of a group of them will approach the curved form, until, if we had an infinite number, we should no longer be able to distinguish the faces of individual prisms, but we should have a mass of them which in section we see on the left in fig. 5. But this will be recognized at once as the section of a magnifying glass, as shown in the right-hand diagram in fig. 5.

A magnifying glass, then, can be used in place of a group of pinholes and prisms; for, when the prisms are so many as to run together into a curve, the pinholes are so many that they, too, run together to form one large hole, which may be the full size of the magnifying glass. In this way we get as bright an image (for the light stopped by the glass of the magnifying glass may be regarded as negligible) as we should from a hole the full size of the magnifying glass; but we also get, what the hole without the magnifying glass would not give us, namely, a distinct image.

The use of the lens, then, obviates the difficulty which we had with the pinhole of getting enough light to enable exposures to be quite short. Let us see how far the other characteristic of the pinhole—the fact that the image is sharp at any distance from the hole—is affected.

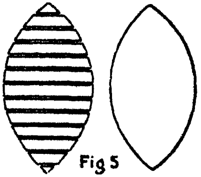


Fig 5

Returning to fig. 3 for a moment, we see that the prism makes the two images coincide on the screen. Imagine the screen taken away, the beams of light would then extend as they are drawn in fig. 6: and we see at once that there is only one position in which we can put the screen to get the two images superposed. It must be precisely at that distance from the pinholes at which the beams cross. At any other we shall get the images separate, and if, instead of two pinholes, we are using an infinite number, as we do with a lens, we shall get an infinite number of non-coinciding images. Instead of getting a distinct image we shall get a mere blur.

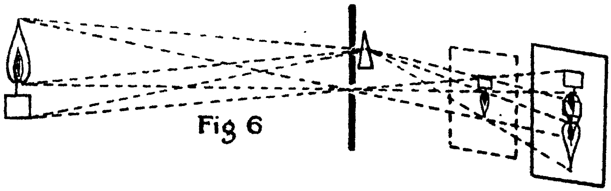


Fig 6

Hence, when a lens is used, we have to put the ground-glass focussing screen of the camera, or the film or plate we are using, at some precise distance from the lens, in order to get a distinct picture. Finding that distance is the operation called focussing.

When a pinhole in place of a lens is used to form an image, there is no need to focus that image. Whether the screen is four inches or four feet from the pinhole, the image is equally sharp—as sharp, that is, as the pinhole will make it. (Pinhole images are never as sharp as can be made with a lens; but they can be very much sharper than a good many photographers seem to realize, or than they are often seen in reproductions.)

The differences between the image obtained with a pinhole on a screen at one distance from the hole, and that which is obtained at another distance, are twofold. One will be seen on comparing figs. 7 and 8. It is quite evident that as the rays diverge again after passing through the pinhole the further the screen on which the image is received is from the pinhole, the larger will be the scale of the image. In fig. 8, if the height of the image of the candle is measured it will be found to be just one-half that of the candle flame itself; whereas in fig. 7 the image and the original flame are of equal height.

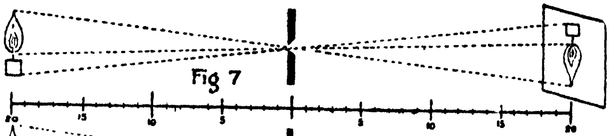


Fig 7

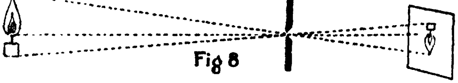


Fig 8

Looking at these two figures more closely, and noting the scale placed between them—the graduations on which may be inches, or centimetres, or anything we like, in fact—it will be seen that in fig. 8, where the image is one-half the length of the original flame, the distance of the screen from the pinhole is one-half the distance of the flame from the pinhole. In the other case, where the image is the same size as the original, the distances of the image and of the original from the pinhole are equal.

These are important matters to note, as when we come to use a lens in place of a pinhole in our ordinary photographic work, we shall find that the same rule holds good throughout. That is to say, the proportion which any distance represented in the image bears to that distance in the original will be the same as the proportion between the distances of the image and of the original from the lens. If we are photographing a church tower 120 feet high, and in our photograph it appears three inches high, as the tower is then 480 times as high as its image in the picture, we may be quite sure that the distance from the lens to the tower was 480 times the distance from the lens to the photographic plate when the photograph was taken. It follows that whenever we are photographing anything in such a way that the picture is on the same scale as the original (life size, as it is called), we must have the lens exactly midway between the original subject and the plate, just as the pinhole is shown in fig. 7.

The other difference to be observed between the conditions in figs. 7 and 8 is not visible in the sketches, but will be readily understood. Assuming that the size of the pinholes in each of these sketches is the same, it is evident enough that the amount of light getting through them is the same. In other words, we cannot imagine that by moving the screen on which the image is received nearer to or further from the pinhole, we can alter in any way the actual amount or intensity of the light which is getting through that hole. Movement of the screen may alter what we do with the light afterwards, but it cannot alter the intensity of the light getting through.

Now in fig. 7 the height of the image of the candle flame is twice what it is in fig. 8. But in addition to the height of the image being doubled its width is doubled. So that if we imagine, for the sake of simplicity, that the candle has a perfectly square flame, measuring an inch high and an inch wide, the image of that flame in fig. 7 will also measure an inch high and an inch wide, while in fig. 8 it will only measure half an inch high and half an inch wide.

The two images are represented in fig. 9: the dotted lines in the one figure dividing it up into areas half an inch by half an inch.

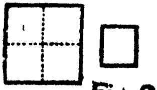


Fig 9

We see at a glance that in fig. 7 the *area* over which the light which has come through the pinhole has been spread, is four times as large as it is in fig. 8. So that while the distance of the screen from the pinhole has been doubled, the area over which the light is spread has been increased four times.

Anyone who cares to draw other diagrams on the lines of figs. 7 and 8 can soon satisfy himself that if the distance of the screen from the pinhole is trebled, the area is increased nine times; if the distance is quadrupled, it is increased sixteen times, and so on. We express this by saying that the area over which the light is spread increases as the *square* of the distance of the screen from the pinhole.

The case of a lens is a parallel one in this respect. The photographer in his practical work will be continually coming up against this connection between the distance of the screen or plate from his lens and the strength of the light; because the strength of the light affects the exposure which he has to give. If the area over which the light is spread is increased four times, the exposure of the plate or film must also be four times as long to obtain the same effect upon the sensitive substance. The rule applies also to the direct light from a lamp, as every bromide or gaslight printer knows: when making a print by artificial light, at double the distance from the light, for instance, we must give four times the exposure.

We saw from fig. 6 that the two images formed by the two holes coincide on the screen which is represented by dotted lines, but do not coincide on the other screen. Only when the screen is in the correct place will the two images coincide; or, as we say in photography, only when we have focussed shall we get a sharp picture.

But reference to fig. 6 will also show us something else which we must note. One can see at a glance that the images on the more distant of the two screens are on a larger scale than the image on the nearer (dotted) screen; and we have seen in figs. 7 and 8 that the farther the screen was placed from the pinhole, the larger was the scale of the image on it. This would also apply to a lens, but for the fact that, as we see in fig. 6, we cannot put the screen just where we like, but must put it where the rays from one pinhole would cross the rays from the other. Therefore, while with a pinhole in place of a lens we can put the screen at any distance we like, and so get an image on any scale we wish, with a lens we cannot do so.

Suppose, then, that with the candle as shown in fig. 6, and the two pinholes there depicted, we wish to get a single sharp image on a larger scale—on the scale, say, of the two images on the more distant screen in the figure (the two that do not coincide). If, in place of the prism shown in fig. 6, we use a prism which forms a more acute angle at its point—one, that is, which has its two sides more nearly parallel—the bending effect on the rays will be less, and therefore the position of the screen on which the two images coincide will be more distant. This is represented in fig. 10.

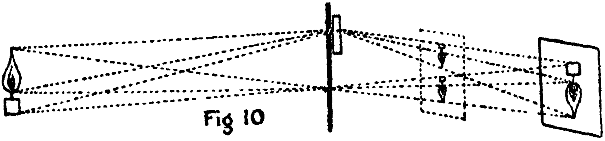


Fig 10

Imagine a host of pinholes, and a host of such prisms, all adjusted to cause the images to coincide at the distance shown in fig. 10, so many that the holes merge into one another, and the prisms form one continuous glass lens, as already described, then we have a lens which will give us a larger image than a lens composed of such prisms as are shown in fig. 6.

As the distance of the screen from the lens when we get the larger image is greater than the distance of the screen from the lens which gives us the smaller image, and as the position of the screen to get a clear picture is known as the "focus," we say that the lens which allows the screen to be farther away is a lens of longer focus or of greater focal length than the other.

We have now seen (1) that with a pinhole we can put the screen at any distance from the hole and still get a distinct image; (2) that with each lens there is only one position for the screen, at which, other things remaining the same, the image is distinct; (3) that different lenses may differ in the distance at which they require the screen to be placed; (4) that the greater that distance, the longer the focus of the lens, and the larger the scale of the image.

CHAPTER IV

How a Lens Works—*continued*

Positive and Negative Lenses—Long and Short Focus—The Angle Included—The Effects of Stopping Down—Fixed Focus Cameras—How Stops are Numbered—The f/ System.

LENSES, whether they are found in microscopes, telescopes, spectacles, opera glasses, cameras, magic lanterns, pocket magnifiers, or any other kind of optical instrument, may be divided into two broad classes, positive lenses and negative lenses. Positive lenses are those which act as magnifying glasses; negative lenses are those which act as diminishing glasses. One can tell in a moment whether any particular lens must go in one class or the other by holding it as a magnifier and looking through it at some suitably placed object. If the object looks larger, it is a positive lens; if smaller, a negative lens. The spectacles used by old or far-sighted persons are fitted with positive lenses; the spectacles used by short-sighted persons are fitted with negative lenses.

For photography we require a positive lens, as a negative lens does not form an image. Any magnifying glass whatsoever can be used as a photographic lens, and if used in favourable circumstances will give a good clear picture. The reason why photographic lenses are usually very elaborate and costly is that photographers wish to have lenses they can use in unfavourable circumstances, and therefore complex combinations of glasses have been designed and made to meet their demands.

It will be seen that the difference between the state of things in fig. 6 and that in fig. 10 is that the prism in fig. 6 exercises a more violent bending action on the rays than that shown in fig. 10, the result being that in fig. 6 the rays come together on the nearer screen (the dotted one), whereas in fig. 10 they come together on the more distant screen. It will have been noticed also that the prism in fig. 6 has been drawn with its two sides forming a very decided angle, whereas in fig. 10 they are almost parallel. This is not an accidental oversight of the draughtsman.

Substituting a lens for the pinhole in each case, we might expect to get a lens something like A in fig. 11 from a series of prisms such as we have in fig. 6, and one like B (fig. 11) from a series such as in fig. 10. If lenses of these two sections respectively were made of the same material, we should find that when we focussed an object at some definite distance from the camera with A and with B respectively, there would be a difference in the images obtained of the same character as that between the images in figs. 6 and 10. That is to say, with a lens like A we must have the screen nearer to the lens than with one like B, and A would give us a picture on a smaller scale than B. A photographer would describe the difference between them by saying that B was a lens of longer focus than A. In comparing two such lenses as magnifying glasses, we should find that A magnified more than B.

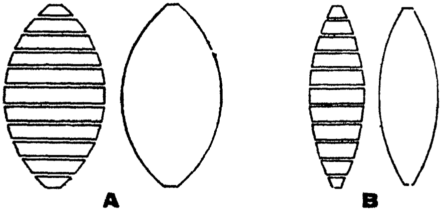


FIG 11.—Short and long focus lenses.

When I wrote just now that A would give a picture on a smaller scale than B, I did not mean that the picture itself would necessarily be smaller, but only the size of the different objects represented in it. It might happen that the whole picture given by A was larger than that given by B, but the images of individual objects would be smaller; so that there would be a greater area of the subject included in the picture given by A. For this reason, a photographer might describe A as a lens of " wider angle " than B.

One difference between a lens and a pinhole which has been pointed out is that with a lens we have to focus, whereas with a pinhole focussing is unnecessary. Glancing at figs. 6 and 10 again for an instant, we see that in the state of things represented in fig. 6 the screen must be placed in the dotted line position for the two images to coincide ; in fig. 10 it must be placed in the more distant position.

Finding the correct position for the screen is the operation called focussing, and if the arrangement of pinholes and prism shown in figs. 6 and 10 gave a bright enough image on the screen, we could find the proper place for the screen by moving it to and fro until we saw distinctly that the rays from the two pinholes no longer gave two separate images, but only one. Having found that position, it might be asked why it should not be fixed once for all. We know that in many cases, at any rate, the photographer has to focus his picture before he takes it. Assuming that we keep to the one lens, where does the need for this repeated focussing arise ?

With certain types of apparatus it does not arise. We can buy cameras and lenses of what is called " fixed focus." The positions of the lens at one end of the camera and of the plate or film at the other are fixed by the maker, and there is no focussing to be done. We could not do it, even if we wished. But while this applies to certain simple outfits, the great majority of cameras are provided with an arrangement by which they can be focussed before a picture is taken.

The reason why there is any need for this is that the positions of the screen as shown in figs. 6 and 10 only hold good while the object is at one particular distance. If we took the candle, which is represented as the object in these diagrams, and moved it nearer to the pinholes (or lens), we should find as we did so that the position at which the two groups of rays met and gave a sharp image would be further away from the pinholes than before. If we moved the candle away, the position would be nearer. Thus, while in fig. 10 we have a larger image of the candle than we have in fig. 6, we could get as large an image with the arrangement shown in fig. 6, if we moved the candle nearer to the screen in which are the pinholes.

It will be found that whatever may be the lens which we are using, in the case of all but distant objects, the nearer the object is to the camera, the greater must be the distance between the lens and the plate or film in order to get a sharp picture In small sizes this difference may be too small to call for any actual focussing to be done; but it exists all the same.

Many hand cameras, and some stand cameras, are very limited in what is called "extension"; and in consequence those who use them find that they cannot photograph very near objects with them at all. They cannot get the lens as far away from the screen as is necessary to get a sharp image with such near objects.

We have already seen that lenses may differ from one another in "focus," or in "focal length" as it is called, and reference was made to lenses of "wide angle." The subject cannot be left here, however, as these terms refer to two of the most important qualities of a lens. I am often asked whether I recommend some particular lens with a fancy name for some purpose, but am not told what is the focus of the lens it is proposed to use. Yet for most purposes it is more important for the photographer to have a lens of the right focus than of any particular make; because one can often tell from a photograph whether it has been taken with a lens of suitable focus, whereas one cannot usually tell whether it has been taken with this make or that.

Let us suppose a darkened room, with a lens fixed in an opening in the window shutter. If we hold a sheet of white card at the right distance from that lens we shall see on the card an image of what is outside the window. If the lens is one designed for a comparatively small plate, say a quarter-plate (4¼ × 3¼ in.), and the card is a foot square or more, the lens will not form an image over the whole of the card. The picture on the card will be a circular one, and beyond the circle the card will be dark. The circle will not have a hard and fast outline, but its boundaries will gradually get darker and darker.

If we draw on the card a rectangle 4¼ × 3¼ in., the size of a quarter-plate, we shall find that the picture formed by the lens extends well beyond it. Possibly we can draw a rectangle 8½ × 6½ in. (whole-plate) on the card, and still not go outside the boundary of the image, although it is sure to be rather dark towards the corners of that rectangle.

Taking care to hold the card at right angles to an imaginary line drawn straight through the centre of the lens—which line may be taken as indicating what is called the "axis" of the lens—we can hardly fail to notice that, while we get a perfectly distinct picture in the centre of the circular image, the picture towards its edges is not so distinct.

Every photographic lens has one or more stops, or an iris diaphragm—means for varying the size of the circular hole through which the light passes. We shall see the purpose of the stops shortly. For the moment, if the lens has various stops, we will suppose that the largest opening of all is in use. The photographer calls this using the lens at full aperture. If in such a case we got a good distinct image over a circle 5½ inches in diameter—which it will be found will just take a quarter-plate within it—we should say that the lens, at full aperture, would "cover" a quarter-plate. Such a lens would answer for a quarter-plate camera. If the circle within which the image was very distinct was a good deal larger than 5½ inches in diameter, so much the better, as it would allow us to use the lens on a quarter-plate camera which is fitted with a movement known as a "rising front."

Most quarter-plate cameras are fitted with lenses the focus of which is somewhere between 4 and 6 inches. If such a lens is fitted in a hole in a shutter in the way described, the card will be somewhere between 4 and 6 inches from the lens when distant objects outside are sharply focussed on it. Let us suppose that the circular picture on the card is, say, at least more than ten inches in diameter. The picture will then be large enough to include a whole-plate (8½ × 6½ in.). The objects towards the outside of the circle may not be very distinctly defined, but we are assuming that they can be seen.

If we make such a diagram as that in fig. 12, in which A represents a side view of the lens in section, B C its axis, and D E the cardboard screen on which we are receiving the image, then the inner circle may represent that part of the total image which would be required by a quarter-plate, and the outer one that required by a whole-plate. The lines A F and A G represent the boundaries of the beam of light coming from the lens when a quarter-plate, and A H and A J when a whole-plate is concerned. If we make A K, the distance of the card from the lens, five inches, assuming it to be a five-inch lens we are using, F G 5½ inches and H J 10½ inches respectively, we shall get two angles at A, F A G and H A J, which, if we measure, we shall find to be about 58° and 92° respectively. If a five-inch lens is being used on a quarter-plate, therefore, we say that it includes an angle of 58°. If a lens of the same focus were being used on a whole-plate, it would include an angle of 92°, which would be considered a very wide angle indeed.

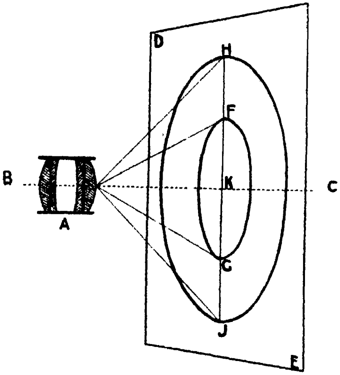


FIG. 12.

For reasons which will appear subsequently, for ordinary photography it has been found that it is better not to use a lens including an angle of more than about 60°. For special purposes, we may require one including much more than that ; we call such a lens a wide-angle lens. So that a five-inch lens would be one of moderate angle, if we used it on a quarter-plate ; it would be a wide-angle lens if we used it on a whole-plate. It would be a much better (and, probably, a more expensive) lens if it could be used on a whole-plate ; but most quarter-plate lenses, examined in the way described would not give a circular picture anything like large enough to take a whole-plate.

Suppose that while we are watching the image on the cardboard screen we gradually diminish the size of the opening in the lens, an operation which the photographer calls "stopping down." The first thing we note is that, as might have been expected, the image on the screen becomes darker.

This, however, is only incidental to stopping down. We do not usually stop down in order to get it darker: in fact, it would be a very great thing for photography if we could get the other advantages derived from stopping down without this darkening. Unfortunately we cannot.

If we look at the distinctness of the image on the screen—which, we have already seen, gets less as the eye travels away from the centre of the picture and nearer to its circular boundary—we can hardly fail to notice that the more we stop down, the further out from the centre does the area of distinctness extend until, when we have a very small stop indeed, the distinctness will extend over almost the whole visible picture. Therefore it does not at all follow that a photograph with a beautifully clear and distinct image all over it has been taken with a very fine lens. Of course, it may have been, but equally, of course, it may not. We cannot say whether the lens was a remarkably good one or not, unless we know how large was the stop when it was taken. We should also have to know how wide is the angle the picture includes.

Photographic lenses, although in essence merely ordinary magnifying glasses, are actually very elaborate combinations of glasses of different materials and curvatures, designed to give as distinct an image as possible, over as wide an angle as possible, and with as large a stop as possible. It follows that such fine lenses are necessarily costly; and it must not be supposed that one can pick up by some lucky chance some altogether exceptional specimen of some cheap kind of lens. Such instruments cannot be made by accident, and the methods of lens-making now employed tend to produce a very uniform run of instruments. Lenses of the same pattern and make may differ slightly amongst themselves, but they will not differ enough for the average amateur to detect.

If the photographer does not impose very severe conditions, he can get beautiful definition in his pictures without the aid of a fine lens. The conditions under which he can dispense with a costly lens are that he must not require it to include a wide angle or to work with a very large stop. Unfortunately for the purses of photographers, they generally find that they *do* want to include a fairly wide angle, and that the larger the stop the better. In hand camera work a large stop is of great importance, as we shall see later on; and so it comes about that for hand cameras, the finest, and, in proportion to their size, the most expensive, lenses are favoured. If the photographer is content to use his camera on a stand, and does not want to give exceedingly short exposures with an instantaneous shutter, he can do as fine work in many directions with a lens costing him a few shillings as, if done under the conditions imposed by using the camera in the hand, would involve a lens costing as many pounds.

Returning to the subject of stopping down and the change it made in the image, we may notice something else. The objects out of doors, which form the subject of the image on the screen, are at all degrees of distance from the lens. Overhanging the window there may be some foliage, which is only three or four feet away; a fence ten or twelve feet may also be included and some trees possibly half a mile or more. We saw that when we varied the distance of an object from the lens we had to vary the distance of the screen also to get a sharp image. The nearer the object to the lens, the farther the screen had to be from the lens to get the image sharp. So that when the screen is at the right distance from the lens to get the distant trees sharp, the image of the fence will be blurry, and that of the overhanging foliage still more blurry. If we move the screen a little farther away from the lens, we get the fence sharp, we get the foliage round the window not quite so blurry as before, but still indistinct, but we also get the distant trees blurry. Increasing the distance of the screen still more, we get the foliage sharp, but then the fence is blurred, and the distant trees still more blurred.

If we use a smaller stop in the lens, we find this state of things much improved. We may be able to get both the distant trees and the fence, or else the fence and the foliage near at hand, both distinct at the same time; while if we reduce the size of the stop still more, we shall find that we can get all three quite distinct at once.

It is very important to distinguish clearly between the two changes which are produced in the image by stopping down the lens.

If all the objects which are included in the picture are the same distance from the lens, we shall find that with a large opening in the lens the image is more distinct in the centre than it is towards the boundary of the circle forming the picture. How far the area of distinctness extends depends on the quality of the lens. The wider the angle over which we can then get fine definition, and the larger the opening in the lens which can be used, the better the lens. Stopping down the lens, by extending the area over which there is fine definition, enables a poor lens to give as good definition as a good one; but at the price of having to use a small stop, and so losing much light and prolonging the exposure.

But as far as stopping down to bring near and distant objects into focus simultaneously is concerned the poor lens and the expensive lens are on equal terms. "Depth of focus," as the quality of getting objects at different distances well-defined at the same time is called, depends on the size of the stop, and on practically nothing else. So that while an expensive lens may work at a larger opening than a cheap one, it may so happen that we wish to use it on subjects the different parts of which are at such widely different distances that we have to stop it down until it is not used at any larger opening than the inferior lens. It is not intended to suggest by this that a poor lens is as useful as a high-class instrument; it is not. But one must not expect impossibilities, and there are limits which the finest product of the optician's skill cannot pass.

"Stopping down" (using a smaller stop in the lens) has, then, two advantages. A lens of poor quality is made to give a more clearly defined picture over the whole of the plate (even a very poor lens will usually give a clearly defined image in some part of the plate); and with all lenses, good or bad, it enables us to get both near and distant objects distinct at the same time. The smaller the opening in the stop, the greater may be the range of distances within which clear definition can be obtained.

These are the two purposes for which stops are used. Incidentally, a small stop lets less light through to the plate than a large one; so that if, for any reason, we may wish to lengthen the exposure we propose to give, we can do so by using a smaller stop.

One question often asked is what stop should be used for such and such a class of subject, and the reply to this is that no rule of that kind can be laid down at all. For reasons which need not be given here, it is almost always advisable to use the largest stop which will give the definition required; and if the camera has a good ground-glass focussing screen, one can see by actual trial what this stop will be in any particular case.

When the subject is one which includes nothing nearer than, say, ten or twelve yards from the camera, it will usually be found in the case of a quarter-plate camera that the largest stop of all will give everything sufficiently sharp. If there are nearer objects as well as distant ones, it is often possible to use the largest stop by focussing on the nearer objects, and letting the distant parts be shown as slightly indistinct. It is noteworthy that while any indistinctness in a near object is almost sure to be objectionable, the eye will tolerate a good deal of indistinctness in distant subordinate parts of the subject, provided the nearer and more important parts are clearly seen. These are matters on which one cannot dogmatize, no hard and fast rules can be laid down. Each photographer must settle for himself what degree of distinctness he requires in the different parts of his subject, and must focus and use his stops accordingly.

At first, in all probability, he will wish to have every part quite clearly defined; but if he is the user of a hand camera, this may be impossible, because with a great majority of the subjects which one wishes to photograph there is such a range of distances included in the picture that were we to get them all sharp we should have to use a small stop. A small stop cuts down the quantity of light entering the camera to such an extent that it is no longer possible to give very short exposures successfully. Therefore, we must either use a small stop, put the camera on a stand, and give an exposure of perhaps a second or more, or else we must use a large stop, resting satisfied with a compromise between having the near and the distant objects clearly defined, and so be able to give a "snap" exposure.

Some of the simpler forms of hand camera are what are called "fixed-focus" instruments. In these no means are provided for varying the separation between the lens and the plate ; it is fixed once for all by the maker. It is usually fixed so that very distant objects are not quite sharply defined, but are sharp enough to make little or no difference. The distance at which objects must be with such cameras to be rendered as sharply as possible varies. It is generally, with a quarter-plate, somewhere between six and twelve yards ; but what it is should be found by actual trial with the largest stop, and noted. If the lens of such a camera has several stops, by using successively smaller stops, nearer objects may be photographed sharply, and at the same time the distance becomes more distinct also. But such small stops, it must not be forgotten, may prevent us from using the camera as a hand camera.

Supplementary lenses, known also as "magnifiers," are supplied for use with fixed-focus cameras. By attaching one of these in front of the camera lens, it is modified so that objects at some other distance are sharply rendered. Thus with a " three feet " magnifier in position, an object three feet from the camera will be sharp. A magnifier, while making the objects at one distance sharp, throws out of focus those at the distance which was originally rendered sharp.

Although the idea of a fixed-focus camera may seem very attractive to the novice, by suggesting to him that it removes the difficulty of focussing, this is not quite correct. It certainly enables a camera to be made more cheaply, but there its advantage begins and ends. For any camera can be used as a fixed-focus camera by setting it to a certain degree of extension and leaving it at that.

If the reader has a focussing hand camera which he wishes to use as a fixed-focus camera, all he has to do is to insert the largest stop and turn the camera on some general view, including objects, say, a hundred yards or more away. Let him focus these as sharply as possible, and then turn the focussing screw a very little more, so as to increase the distance between the lens and the ground glass or plate a trifle. He must stop as soon as there is any sign that the image of the distant objects is getting more indistinct than he can tolerate ; and when this point is found, he can make a mark on the camera to indicate the extension. Whenever the camera is to be used as a fixed-focus instrument, it is opened out to this mark and left at it. A trial or two will show how near with that extension, an object can be and still be sharp. Objects that are any nearer than this cannot be photographed sharply with the camera used as a fixed focus instrument, unless a smaller stop is used in the lens.

Fixed focus cameras usually have cheap lenses which necessitate comparatively small stops ; so that objects may be fairly near to such cameras (nearer than they could be with a better lens, *i.e.*, one working with a larger stop) and still be in focus. The penalty to be paid for this is that the small stop limits the work that can be done, if such an instrument is to be used as a hand camera, since fewer of the subjects which we wish to photograph are so brightly illuminated as to allow of them being " snapshotted " with the small stop of the fixed-focus camera.

In the case of cameras giving pictures 3½ × 2½ in. or larger, it is only the lower-priced patterns which are of fixed focus, since fixed focus in such sizes necessitates the use of a lens with a comparatively small stop. The better instruments are fitted with more costly lenses which can be used with larger stops, and to take advantage of these, a focussing device is a necessity. But in smaller sizes, lenses of shorter focus can be used ; and with these there is less need to stop down or to vary the extension of the camera to obtain images of near and distant objects sharp at the same time ; so that even the better cameras in very small sizes may be of fixed focus. Thus in the case of the little pictures given by a ciné camera, there is seldom any need for focussing : the lenses are so short in focus that they will give near and distant objects sharp simultaneously and yet pass enough light for very short exposures to be possible. But even these are generally fitted with a focussing arrangement, except in the cheaper forms.

It is very important to give a correct exposure, and we have seen that the size of the stop, as, indeed, is obvious enough, affects the quantity of light entering the camera. In order to be able to determine the exposure accurately, it is necessary that we should know to what extent it is affected by the particular stop or working aperture of the lens which we are using.

Although at first sight, one might suppose that in this respect, the only thing that mattered was the actual size of the opening in the stop, this is not so, for a reason which has only to be mentioned to be realized. Consider the camera for a moment as represented by a room, the lens as a circular window at one end of the room, the plate or film as a picture or other flat object on the wall opposite to that containing the window. If the window looks out on an open view, it is evident that the larger the window, the more daylight will fall on the picture hanging on the wall opposite the window.

But we can get more light on to the picture in another way than by enlarging the window—namely, by taking the picture off the wall and carrying it nearer to the window. The intensity of the light falling on the picture is governed by two factors, the size of the window and the distance of the picture from it. The intensity of the light falling upon the plate or film in the camera is, in much the same way, governed by the size of the opening or stop in the lens, and by the distance between the lens and the plate or film. As a matter of fact, there is no need to know the actual size of the opening in the stop in inches or fractions of inches, provided we know the proportion which it bears to the distance of the lens from the plate or film, since all lenses and stops, no matter how big or small they may be, allow the same intensity of light to reach the plate, provided the proportion of the size of the opening to the distance is the same.

If we have a lens with a stop two inches in diameter across its circular opening, and that lens has a focus of twenty inches, it is evident that the proportion of stop to focus is as 2 : 20 or as 1 : 10. If the stop is only a quarter of an inch in diameter, and the lens has a focus of 2½ inches, the proportion of stop to focus is ¼ : 2½, which again is 1 : 10. If we could imagine a lens with a stop two feet in diameter, and a focus of twenty feet, the proportion would still be 2 : 20 or 1 : 10. If other conditions remained the same, all these lenses would require precisely the same exposure. The plate which was behind the two-foot opening would receive no more light than the one behind the quarter-of-an-inch opening ; because what was gained from the larger opening would be lost by reason of the greater distance of the lens from the plate.

For this reason, a photographer does not trouble to know what is the diameter in fractions of an inch of the opening in his stop ; since that by itself tells him nothing of the effect of that stop upon exposure. What he does need to know is relationship between the size of the stop and the focus of the lens. All methods of numbering stops are based upon this, and express that relationship in one way or another, though there are different systems by which it is done.

The most generally used system, one which bids fair to supplant all others, is that by which each stop is marked with what is called its f/- number. This means nothing more nor less than the number obtained by dividing the focus of the lens by the diameter of the stop. Thus, in the case of the three lenses just referred to, the stop in each of these would bear the same mark, namely, " f/10," because the focus in each case was ten times the diameter of the opening in the stop.

It will now be evident how it comes about that I can give no answer to such a question as this, which has been put to me often enough, " What is the f/- number of the stop in my lens ; it is just half an inch across ? " It is only because the enquiry applies to an unfamiliar object that the enquirer fails to realize that such a question is paralleled by asking, " What is the length of my garden ; there are just twelve inches to the foot ? "

It is a very simple matter to ascertain the f/- number of the stops of a lens with sufficient accuracy for exposure purposes. We must first find the focal length of the lens, which we do by focussing some distant object, and then measuring from the stop in the lens to the focussing screen. In a fixed focus camera we can measure from the stop to the film or plate, which can be done near enough on the outside of the camera. Having found the focus in this, or any other of the many ways described in the text books, we can ascertain the f/- number either by finding the diameter of the stop in fractions of an inch, and by dividing the focus in inches by such fraction, or by ruling a line equal in length to the focus, dividing it up into sections each equal to the diameter of the stop, and counting up the sections, the number of which will be the f/- number. Almost all lenses are now marked with the f/- number of their stops, and in such cases one may take the markings as correct.

The method which has just been described does not give the f/- number with great accuracy, and it is not applicable to telephoto lenses. But with all the lenses likely to be met with by the beginner it is near enough for exposure purposes. If it is wrong at all, it is almost sure to make out the lens to be a little slower than it really is ; but such an error is one in a safe direction, since it may lead the photographer to give a full exposure, which is always better than an under-exposure.

CHAPTER V

Kinds of Lenses

SINGLE UNCORRECTED LENSES—ACHROMATIC LENSES—RAPID RECTILINEARS — ANASTIGMATS — CONVERTIBLE LENSES—INSTRUMENTS FOR HAND CAMERA WORK, FOR LANDSCAPE AND ARCHITECTURE, FOR PORTRAITS

THE simplest lenses of all which are employed in practical photography are to be found in fixed focus daylight enlargers. These are usually nothing more then plain spectacle lenses or magnifying glasses, composed of a single piece of glass. As daylight is powerful, a very small stop can be fitted to them ; and so, even so simple a lens as one of these can be made to give a sharp image. If the photographer examines such a lens he will find that it has a focus of three inches or less ; while the diameter of the opening in the stop fitted to it may be less than one thirty-second of an inch : so that the lens is working with a smaller stop than f/96.

Although the cheapest hand cameras are provided with what is called a " single " lens, it is actually one composed of two glasses cemented together with Canada balsam. Such a lens is sometimes called an " achromatic meniscus." Properly constructed, these lenses will give very fair definition with f/14 or f/16 when they include an angle of about 60°, which is approximately that at which they are used. If the lens is used at a decidedly smaller angle, the working aperture can be enlarged to f/11 or f/8 ; while if the stop is kept the same, the character of the definition towards the corners of the plate will be better. There are more elaborate " single " lenses composed of three or even four glasses cemented together. They are true " anastigmats," and can be used at an angle of 60°, or thereabouts, at f/11, and will give critically fine definition over the whole plate. They are not to be found ready fitted to cheap cameras, however, as they are costly. Some of the finest anastigmats consist of two such lenses used together. They then work at f/6 or thereabouts, and are referred to later.

The reason why hand cameras are not supplied with such single anastigmats is that a large aperture is very important for hand camera work; and if something a little better than an "achromatic meniscus" can be provided, a "rapid rectilinear" will give a greater increase in rapidity than the single anastigmat, though without the very fine definition of the latter. Nearly all rapid rectilinears, or "R.R.'s," as they are written, work at f/8. With such an aperture, over an angle of 60°, they give distinctly better definition than the "achromatic meniscus." In very small sizes, and for special purposes, they have been fitted with f/6 or larger apertures, but at the expense of the definition towards the margins of the picture.

When a more rapid lens than one at f/8 is required, we come into the class of "anastigmats." Some of these only work at f/7.7 (which is practically f/8) or at f/8; but at this aperture they should give distinctly better definition toward the corners than an R.R. at the same aperture and including the same angle. Anastigmats of various patterns are made to work at f/7, f/6.8, f/6.5, f/6, f/5.6, f/4.5, and some at f/4, f/3, or even at larger apertures than that.

Any of these, critically examined, should give at its full aperture, and over the same angle, as fine definition as the f/8 anastigmat of the same focus gives at f/8, and very distinctly finer definition than the R.R. with similar conditions. But there are degrees of fineness, even among anastigmats.

Some anastigmats and all rapid rectilinears are "convertible." That is to say, part of the lens may be removed, and the part which is left can be used by itself. The part will have a decidedly longer focus than the whole lens. It is customary to assume that the focus is doubled, but this is only a rough approximation; and if the difference is not known, it should be found by trial.

As the size of the stop remains the same, while the focus is increased by removing part of the lens, the f/- numbers of the stops are altered proportionately to that increase. Unless the camera has "double extension" or more, there is no advantage in a convertible lens, as the " single combination," as it is called, cannot be used without the greater extension.

Claims are sometimes made for lenses that their single combinations can be used alone, which claims, while justified in the letter, may, at times, be misleading. It must not be forgotten that while any positive lens, that is to say, any lens that will act as a magnifying glass, *can* be used to take a photograph, the photographer cannot make much use of such a lens unless it will work with a fairly large stop. A seller, therefore, is hardly justified in saying that a lens is " convertible," or that its single components can be used separately, unless this can be done without having to use a much smaller stop than that in the complete lens.

Thus, if the complete lens works at f/6.5, its single component ought to give an image of equally good definition with that same stop. The f/- number of that stop, it should not be forgotten, is no longer f/6.5, although the size of the opening has not been altered. If the half lens has twice the focus of the complete lens, f/6.5 will become f/13, and so on in proportion.

Omitting telephoto lenses, which hardly come within the scope of the beginner, these are the principal types likely to be met with. There are also " portrait lenses," which, until anastigmats of large aperture were made, were the only very rapid lenses available, and therefore were those generally used for portraiture. They work at f/3.5 to f/4.5, and are very useful for their own particular purpose ; but they, too, are a little beyond the beginner.

A few words may be added on the purposes to which the different types may be put. Practically all the lenses which have been named are available for all purposes of ordinary photography, when conditions permit ; it is hardly anything but a matter of rapidity.

For hand camera work, for example, f/16 is decidedly slow, so that the possessor of a hand camera fitted with such a lens is limited, as far as snapshots are concerned, to open subjects in a good light, and to those which are not in such rapid motion as to need a very fast shutter. If his lens works at f/8 his powers are proportionately extended ; he can give exposures one-fourth as long in the same light, or exposures of the same length in light one-fourth as powerful and get equally well exposed results. With anastigmats at f/6 or f/4.5 the scope is still wider.

It must not be forgotten, however, that the larger the stop the less capable is the lens of giving near and distant objects sharp at the same time, and the more necessary is it to focus accurately. Many a worker who has got sharp pictures with a cheap camera and f/16 lens has invested in an anastigmat, working, say, at f/6.5, only to find that his pictures are no longer so sharp. Either he is not focussing carefully, or he is attempting subjects which demand more depth of focus than his anastigmat at the large aperture will give. Were he to stop it down to f/16 he would find that it would give him finer definition than his old lens, and would be just as easily worked. A high-class lens is an instrument of precision, and to take advantage of its qualities, one must learn to use it as such.

For landscape work, or for any form of photography in which the camera can be put on a stand and a time exposure given, there is not so much to be gained by the use of a high-class lens. For architecture, for instance, it is not very important whether we have to give five seconds or five minutes, so that little is gained by using a lens at f/6 instead of one at f/16 or f/22.

One characteristic of the single lens, however, must be mentioned in that connection. Such a lens, whether merely an achromatic meniscus or a single anastigmat, is not what is called " rectilinear " ; that is to say, it gives a more or less distorted image. The degree of distortion is often altogether over-rated. One may use such lenses on subjects likely to show it, and never notice it at all, unless it is deliberately looked for, while the vast majority of subjects which the amateur photographer attempts would in no case reveal it. Judging by the distortion due to tipping up the camera, which can be easily put right in reproduction, but which even high-class newspapers and magazines are content to leave unremedied in their pictures, the public at large does not recognize or trouble about distortion at all.

The distortion caused by a single lens is such that when a straight line in the subject is photographed so that it falls near one of the edges of the picture, and more or less parallel with that edge, the line in the photograph is not straight, but is slightly curved. It is only noticeable at all in some architectural subjects and in certain forms of copying; as other subjects do not usually contain such straight lines. Moreover, the narrower the angle included by the lens, the less likely is it to be in evidence. So that while it may be noticed when a camera fitted with a single lens is used, it is not likely to show if we are using half a convertible lens; as such an instrument, used on a plate of the same size as the whole lens is used on, would be including a comparatively narrow angle. It should be added that there are many lenses besides those which are specifically known as "rectilinears" which are rectilinear—that is to say, which do not give this distortion.

A lens for portraits should be rapid, so as to allow exposures to be kept short. It is also advantageous to have it include a narrow angle only. If the lens ordinarily fitted to a camera which, as has been pointed out, usually includes an angle of about 60°, is used for portraits, there is likely to be trouble with what are called "wide angle effects." These are often very noticeable. A sitter's hand, for example, if it is decidedly nearer to the camera than his head, will appear magnified out of all proportion. A shoulder or arm turned towards the camera is similarly distorted. The immediate remedy for such defects is to move the camera farther away, which gives the sitter on a smaller scale. With such a camera and lens, therefore, it will be best not to use the whole of the plate for a portrait, but to be content with cutting a small picture out of the middle of it, and, if this is thought necessary, enlarging. When getting a lens for portrait work only, it is wise to get one of at least double the focus which would ordinarily be used for general work on the same size of plate.

One can summarize the various forms of lenses used by photographers as falling under six heads: (1) single uncorrected lenses, (2) achromatic single or "landscape" lenses, (3) rectilinears (so-called), (4) portrait lenses (so-called), (5) anastigmats, and (6) telephotographic lenses. Of these the beginner is almost sure to use 2, 3 or 5. The anastigmats are put upon the market under a whole host of fancy names, none of which gives much clue to the actual character of the instrument to which it is applied. In choosing a lens, the points to note are, first, under which of these headings it comes ; secondly, what is the f/- number of its largest stop, what is its focal length, and what is the size of the plate it is made to cover ; and thirdly, what is the reputation of its maker. The beginner may be bewildered where selection is so wide ; but the enquiry columns of *The Amateur Photographer and Photography* are intended to help him in just such a case, and, if he writes to the paper at Dorset House, Tudor St., London, E.C.4, he can obtain the assistance he requires.

CHAPTER VI

The Camera

FOLDING HAND-OR-STAND CAMERAS—RISING AND CROSS FRONTS—SWING AND REVERSING BACKS—SINGLE AND DOUBLE EXTENSION—THE LIMITATIONS OF A HAND CAMERA.

IN selecting a camera, a point to remember is that there is much very interesting photography which cannot be done with a hand camera, as such, at all; and much more for

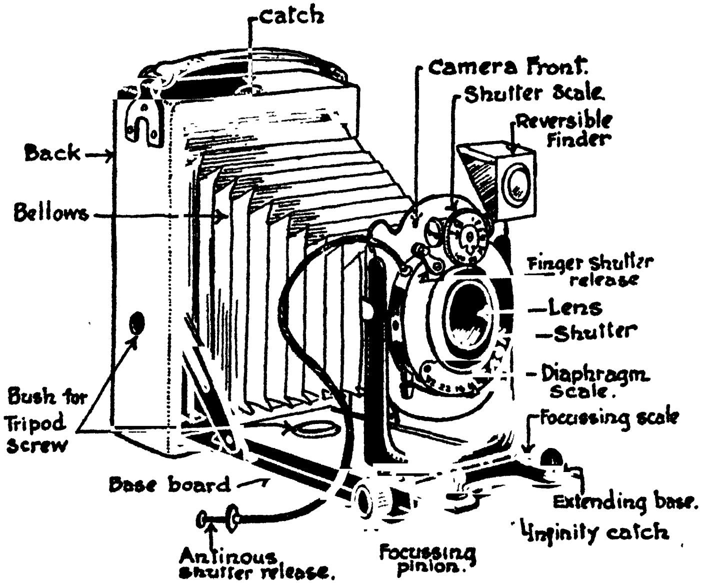


FIG 13.—A folding hand-or-stand camera.

which a camera that is purely and simply a hand camera is not very convenient. Unless, therefore, there is some very strong reason for doing otherwise, or the photographer means to be satisfied always with "snapshots," it is best to get an outfit which, while it can be used as a hand camera, is not limited to such use.

A type which comes within this description is the "folding hand-or-stand" camera, shown diagrammatically on the previous page. Roll-film cameras can only be used for anything beyond snapshot work with inconvenience, and much the same may be said for "vest pocket" cameras. Sooner or later the owner of either of these types, if he becomes keen on photography at all, is sure to find that he wants to do work for which his outfit is unsuitable, and so gets another: whereas the owner of a camera that can be used on a stand as well as in the hand, will find the one instrument suffice. Very small hand cameras have their uses and their good points, but it is easier to learn photography with a camera taking a fair-sized picture, such as quarter-plate (4¼ × 3¼ in.).

The folding hand-or-stand camera, of which the illustration (fig. 13) is a type, is made by most leading manufacturers on the general lines shown. Some of the other designs, such as the magazine camera, the collapsible focal-plane, and the reflex, are very different in appearance, but the various parts are sufficiently alike to be recognized from the lettering on the illustration.

The word "camera" means room; it is identical in origin with "chamber" and the French *chambre.* It is not a misnomer, as the earliest camera was actually a room, being known as a "camera obscura," examples of which are still to be found in some places of entertainment. The camera obscura consists of four parts—the room, which excludes all light except that which comes through the lens; the lens, which is simply a magnifying glass; the table or screen, a whitened smooth surface on which is seen the image produced by the lens; and a mirror so placed that the light from the lens, instead of proceeding straight on to a screen behind the lens, is reflected downwards on to a screen beneath. The mirror is not a necessity: it is only used as a matter of convenience, allowing the screen to be placed where it can easily be seen, and reversing the image right for left, and so neutralizing the similar reversal caused by the lens.

The photographer's camera is the camera obscura reduced very much in size, with the mirror removed altogether, so that the light from the lens falls direct upon the plate, and with some arrangement by which the sensitive surface can be brought behind the lens without any previous exposure to light. So that it is essentially a small light-tight box, with a lens at one end and the receptacle for the plate or film at the other.

For lightness and portability all but the two ends of the box usually consists of bellows, the ends themselves being held securely by being attached to the baseboard of the camera; but in some forms bellows are not employed, and the camera is merely a rigid box of wood or other suitable material.

The part to which the lens is attached is called the front. If it can be moved up and down with reference to the rest of the camera it is called a rising front; if it can be moved from side to side it is a cross front. In the illustration, the rising front movement is obtained by sliding the part carrying the lens between the two arms of its U-shaped support, while the cross front movement is got by sliding the U piece itself from side to side on that part of the extending base which carries it.

Cameras of this type are closed by releasing the front by means of the catch or clamping screw provided, and pushing it right back until it is enclosed in the back. Before doing this it is important to see that if the front has been moved from its central position it is restored to it. The top ends of the two struts which connect the baseboard with the back are next pressed down until they liberate themselves, and the baseboard can then be folded up in front of the lens until it is caught by a spring catch, which keeps the camera closed.

To open the camera, this catch must first be pressed. It cannot always be seen, being covered over by the leather or other material with which the camera is covered, but it will be felt underneath, either in the middle of the top, as it appears in the illustration, or near the top on one side. Pressing the catch releases the baseboard, which is opened out until the two struts "click" into position. One can then catch hold of the front, by the finger piece or pieces provided at the base of it, and draw it forward along the baseboard until it is held in position by what is called an "infinity catch," which cannot well be seen in the illustration, as it is just below the front. It is then ready for use.

In handling cameras of this description, it is very important on no account to force them. There is so much leverage when the top of the front or the end of the baseboard is handled that the instrument can easily be damaged. If it does not open or close quite smoothly, instead of using any violence, the cause of the trouble should be sought out and removed. On no account should the front ever be handled by its top, but always by the finger pieces provided at its base for that purpose. The opening and closing should always be done slowly.

The illustration shows a camera intended to use plates or cut films. If it were a roll-film camera, the back would extend above and below its present limits, providing two receptacles, in one of which the cartridge of film is placed and in the other an empty spool to receive the film after exposure. This arrangement makes it necessary to keep the back of the camera closed in a light-tight manner, except when the spool is changed, and for certain large classes of work this is an inconvenience. To avoid this, many film cameras are provided with a fitting to take plates also, together with a ground-glass screen, the use of which will subsequently appear. The plate holder and the ground-glass screen are attached to the end which is hidden in the illustration. This is called the "back."

In some cameras the bellows are square, and the back is made in two parts, one attached to the bellows and the other a square frame clamping to this. Being square, this frame is reversible, and so we can attach it so as to carry the plate with its longer sides either vertical or horizontal, as the picture may require. This is called a "reversing back." In some more expensive models the reversing back is constructed on a sort of turntable; so that it is not detached but merely rotated, and can be turned from one position to the other without any light entering.

Sometimes the back of the camera is not held unalterably at right angles to the baseboard, but can have its angle altered and can then be clamped in the new position. This is called a "swing back." If it can not only be swung from the vertical position, but also from side to side, it is said to have a "side swing." These movements are not all embodied in many instruments of the "hand-or-stand" type, and are not used when the camera is held in the hand.

Cameras with bellows bodies of the type shown are described as of "single extension," "double extension," and sometimes of "triple extension," as the case may be. The expression is rather vague, as there is no very definite agreement upon what constitutes "single extension," and a double extension camera does not necessarily open out to twice that to which a single one extends. But it is generally understood that a single extension camera will, with the lens usually fitted to it, allow the camera to be opened out enough for landscapes, head and shoulders portraits, etc., and that a double extension camera opens out nearly, if not quite, twice as far as this.

The need for this extension must be taken on trust at the present moment, but later on we shall see that it is a valuable adjustment, so that if possible a double extension camera should be obtained. The extension is the distance between the lens and the plate when the camera is opened out as far as ever it will go.

It is often supposed that the success and quality of a photographer's work depend on the kind of outfit he possesses—the more expensive the outfit the better the work. This is a great mistake. The quality of the work depends on the skill and taste of the photographer, and not on the costliness or elaboration of his outfit.

A very low-priced simple form of camera will give perfect pictures, provided the subjects are not moving rapidly; for some cameras one must even have the subject stationary, or else the work can only be done in a very good light, and when all parts of the subject are well illuminated. As the apparatus improves in quality—and incidentally becomes more costly—the range of subjects with which it can properly deal becomes extended, or it can be used in circumstances when illumination is not so good. For successful work of the highest speed a costly outfit and considerable skill are required; but for the ordinary everyday work of the amateur a comparatively simple equipment will suffice.

None the less, it is wise to get as good an outfit as the beginner can afford; once more, not that his photographs will be any "better," but because it enables him to deal with a wider range of circumstances, or to work when the user of the cheaper outfit is stopped from want of sufficient light. I would say—do not spare expense in the matter of camera and lens, but buy, within reason, the best which the pocket will allow. But, having bought it, do not think that the quality of the work done will be dependent upon it. If the beginner is neat, careful, methodical, and painstaking, he will find that he will very soon master the initial difficulties, whatever his outfit, and his work will please both his friends and himself. If he is untidy and careless, and is prone to explain every failure by alleging that his materials were at fault, or that his outfit was not good enough, he would be wise to choose some other hobby, unless he can bring himself to practise the virtues just named.

It is, perhaps, within the mark to say that nine out of every ten amateurs who take up photography do so with the idea of limiting themselves to what is called snapshotting, that is, giving instantaneous exposures with the camera held in the hand. It seems so much simpler than stand camera work, with all its fuss of arranging, focussing on the ground-glass screen, and then giving an exposure timed to so many seconds. If it were merely a case of simplicity, this idea would be correct; but there are other considerations.

Snapshotting by beginners usually means that many of the exposures are failures, either because all the operations were not properly carried out, or because in the circumstances of the case an instantaneous exposure could not be a success. It must not be forgotten that one of the most serious limitations of the cheaper form of camera is that it can be used for snapshots only in a good light, or else when the subject is one with no deep shadows near at hand.

There is a great difference between hand camera and stand camera work; a difference far greater than is conveyed by such expressions, which merely suggest that in one case the camera is held in the hand, and that in the other it is put on some support. It is well that this difference should be understood before the definite choice of an outfit is made.

In hand camera work, almost without exception, the picture which is to be taken is not seen on the scale in which it will appear in the final print, but is arranged in a supplementary camera called a "finder," which in most patterns is very small. One cannot be sure, therefore, that exactly what is wanted will fall upon the plate: it can only be arranged approximately, with adequate margin for error.

The finder does not give any clue as to the clearness of the image which the lens is forming on the plate, but only acts as a more or less rough guide as to what is being included. The clearness is dependent upon the operation known as "focussing," and in focussing with a hand camera, other than a reflex, all we can do is to estimate with the eye the distance of an object and then set an index on the camera to that distance as marked on a scale. With a stand camera we can actually see when the image is perfectly clear and sharp, by means of the ground-glass focussing screen with which apparatus of that type is provided.

Again, as the camera is held in the hand, a shutter exposure must be given, or movement of the camera would blur the picture; but a shutter exposure is often impracticable, while it introduces other complications. It makes for more rapid progress and success if the beginner uses at first a camera which allows the subject to be examined on the focussing screen, and makes his first exposures on subjects where there is no rapid movement, with the camera supported on a stand.

CHAPTER VII

Apparatus and Materials

AN EXPOSURE METER—THE DARK ROOM—" SAFE LIGHTS " —DISHES AND MEASURES—CHEMICALS REQUIRED—A SINGLE SOLUTION DEVELOPER—HYPO—PRINTING PAPERS.

BEYOND the camera and lens, the outfit required for starting photography need not be either extensive or costly. It has been stated that the camera, even if designed for use in the hand, should be usable on a stand, and some simple form of tripod should therefore be obtained. It is best to get one of wood, folding in two or three. Tubular metal tripods sacrifice too much to extreme portability for general work, though they are useful as an additional item in the equipment.

The camera should also have a case of some kind, though this also is not an absolute necessity. Failing it, a square yard of dark-coloured mackintosh cloth may be obtained, in which it may be kept wrapped up when not in use, the cloth serving also as a focussing cloth.

There is one appliance which should be bought with the camera, as its value, always very great, is at its greatest to the complete novice. I refer to an exposure meter. There are several patterns available, and it is quite unimportant which of these is chosen. What is important is that, whichever is obtained, the photographer uses it persistently from the very first, so as to familiarize himself with it, and to learn as quickly as possible to rely upon it.

The exposure meter, as distinguished from exposure tables or calculators, contains a piece of sensitive paper, which darkens in the light, and thus indicates the photographic strength of the light at the time the exposure is made. One of the greatest conditions of success in photography is correct exposure: and correct exposure is only to be obtained by the use of a meter, or by guesswork gradually made more and more accurate by experience only to be bought with many failures.

A dark room that is set aside exclusively for photography is a great luxury, but it is not in any way a necessity. If there is a room available, then it would be well not to regard it as a "dark room" at all—that is to say, not to darken it permanently, but to make it a work room which can be darkened temporarily as required. Most of the operations of amateur photography can be carried out in ordinary white light, and it is a good thing to be able to have plenty of light in the room when it is not actually in use as a dark room.

We can darken a room temporarily in the daytime by blocking up the window, or we can wait until night before doing dark room work. At night, the diffused light from a starry or moonlit sky will do no harm, if the moon does not shine directly upon the plate: and if there is any strong artificial light outside the window, it can be made harmless by pulling down the blind.

If we are to do the work in the daytime, then the window must be effectively blocked up. The easiest way of doing this is to make a light wooden frame to fit into the window frame and to tack over this some cheap fabric such as unbleached calico. On the calico are then pasted down two layers of brown paper, applying the second when the first is quite dry. The result should be a light but perfectly opaque screen. If any light creeps through the edges of the frame, strips of cloth may be tacked on to stop it. A mat pushed up against the door is quite enough to prevent harmful light coming in from that quarter.

In such a room, all white light being excluded, we can do our work by the light of a dark room lantern—that is to say, a lantern specially constructed to allow no light to get out of it except through what is called a "safe light"—a screen which stops all except red and orange light, to which plates and films are not very sensitive. It is a great mistake to try to save money by getting a poor small lantern. For comfortable work—and unless the worker is comfortable he cannot hope to do as good work as he should—there should be plenty of light of the right kind in the room.

To obtain this a powerful illuminant and a large "safe light" are needed; and in buying a dark room lantern these are the points to which to look. The largest size likely to be stocked by the dealer is none too large for use, and the little lamps with a few square inches of ruby glass in them make successful photography very difficult even to the expert.

If the room to be used is fitted with electric light there is no need to buy a dark room lamp at all. Any fairly roomy cardboard box with a well-fitting lid will do, and all that need be bought is a large "safe light" of suitable kind, which is then fastened securely over a hole nearly as large as itself cut in the bottom of the box. The box is placed on end, a piece of twin flexible wire led into it, and a lamp hung opposite the middle of the safe light. A suitable "safe light" for all ordinary photography is that known as Wratten and Wainwright's Series I, and with such a screen not smaller than 15 in. × 12 in., and a 32 c.p. lamp, the photographer will find that he can see what he is doing quite comfortably, and at the same time will not run any risk of spoiling his materials from undue exposure to light, if he use proper care.

Mention of proper care serves as a reminder to point out that no light which is of any value at all for seeing is quite without effect upon photographic materials. A safe light is not one to which our plates or films can be exposed for any length of time without injury, but only one which if used carefully will not affect them.

By "using carefully," I mean that the light must only be allowed to fall on the sensitive emulsion when this is absolutely necessary. For filling and emptying the camera or slides there is no need to expose the sensitive material to direct light at all. The lamp may be put on a table behind the worker, so that the place where the sensitive materials are is in the shadow of his body; or it may be turned with its face to the wall; or, better still, the work can be done in perfect darkness. When once the photographer has familiarized himself with the order in which plates are packed and with the way in which his camera is loaded, he should be able to do this part of the proceedings without any light at all. During development a sheet of cardboard or a lid should be provided for the dish : so that, while there is plenty of light in the room to enable us to see what we are about, light only falls upon the sensitive surface itself for the very few moments when it is necessary to have a look at it.

Another precaution which should always be taken is to have the dish well away from the dark room lantern. Those illustrations which show a photographer with his dish pushed right up to the lamp, are typical of what should never be done, however pictorial they may be.

Where there is no electric light a lantern of some kind will be a necessity. Incandescent gas makes a good illuminant, and in that case, and also with an oil lamp, the lantern should be roomy and well-ventilated, since it is important to avoid heating, which may be injurious to the safe light. Oil lamps for dark room work are rarely what they should be. The burner, small as it is, is often too large for the lantern, which gets hot, and sometimes causes the lamp to " pop " and give trouble at an inconvenient moment. For in the middle of developing a negative, for example, one cannot leave off to put the lamp right, even if this could be done without having white light in the room.

The beginner may wonder why there should be any need to bother about artificial light if daylight is available ; but daylight, however well screened, is not at all a suitable illuminant for the dark room. It is much too variable. If the safe light is arranged so as to be safe with daylight of ordinary intensity, the room will be too dark on a dull day ; while if the safe light is right for a dull day, it will not be safe when the light is bright. So that it is very seldom that daylight is used for such a purpose : never, in fact, in a well-equipped room. If there is a window so placed that it can be furnished with a safe light and an artificial light can be placed outside the room altogether, the arrangement is good, as this avoids heating the dark room and fouling the air in it with the products of combustion of the lamp.

Dishes are necessary, and in getting these it is well to get one of xylonite, and one, of deep form, of porcelain. If more than two are to be bought, a porcelain dish two or three times as large as the size worked will be found useful. For developing plates the xylonite dish is the one to use. If roll film is to be worked, a dish or two will still be needed for the prints, but the developing is best done in a developing machine.

Scales and weights are not actually required by the beginner, as small quantities can be got by measuring out a stock solution, which itself can be made up without weighing, by dissolving the whole quantity bought.

If a single solution developer is used, the only solution which the photographer need make up is the hypo which forms the fixing bath. A convenient strength for this is one in which each pint of solution contains eight ounces of hypo. To make up this, a pound of hypo as bought is placed in a large jug and about a pint and a half of boiling water is poured on to it and the mixture stirred. When the hypo has dissolved cold water may be added until the solution measures one quart, and when quite cold it is put into a corked bottle and duly labelled.

Two measuring glasses should be obtained. One, a very small one, is known as a minim measure, and should be graduated up to two drams (120 minims), the other should be graduated up to four or six ounces. This latter measure should be cylindrical and not conical in shape, for convenience in cleaning. A jug and a pail will provide a water supply and waste.

If the beginner is going to use gaslight paper for his prints, and this he will find the easiest at first, one printing frame is all he will require ; but if he proposes to use p.o.p. it is a saving of time to have three or four. A common mistake is to get a printing frame the same size as the negatives, with the result that, unless the pictures are to be freely trimmed down, they often show defective edges. It is always better to have the frame a size or two larger. For example, half-plate (6½ × 4¾ in.) is the most convenient size for a printing frame for quarter-plate or 5 × 4 negatives. It is provided with a piece of clean glass, and on this is placed a piece of thin card having an opening in the centre of it just large enough to take the negative and keep it from sliding about. In such a frame we can print right up to the extreme edges of the negative without showing any falling off. Film negatives are merely laid upon the glass without any card.

A bottle of a concentrated single solution developer, a pound or two of hypo, some plates or films, and some gaslight paper are all that will be needed at first. The gaslight paper should be of the " ordinary " grade. Most makes are obtainable in two grades—" ordinary " or " contrasty " and " portrait " or " soft." The ordinary grade gives brighter prints than the other, and as the beginner's negatives are more often too weak than too strong, the ordinary grade is to be preferred, —either " glossy," or " platino-matt " which has a dead smooth surface like that of a fine drawing paper. The glossy, as the name indicates, has a shiny or enamelled surface. Either can be purchased of postcard thickness ; and, as this is much less likely than thin paper to be injured when handled by anyone not accustomed to the manipulation of paper prints while wet, it is to be preferred.

CHAPTER VIII

Types of Plates

RAPIDITY IN PLATES—NUMBERS ON PLATE BOXES—ORTHOCHROMATIC PLATES WITH AND WITHOUT A COLOUR SCREEN—SELF-SCREENED PLATES—BACKED PLATES.

A GLANCE through the price list of one of the leading platemakers reveals the fact that he provides a number of plates of different kinds, amongst which the photographer has to choose. There is the "ordinary" or "landscape" plate, which is certainly not the best kind to use for landscape work in spite of its name. Then there is one which is described as "extra rapid" or "instantaneous," or by some similar term implying rapidity, and is quoted at the same price as the "ordinary." There is probably a third, still more sensitive, perhaps claiming to be "the fastest plate made," and sold at a higher price. These three are not "orthochromatic" or "isochromatic," the meaning of which terms will be pointed out in a moment. There may be other non-orthochromatic plates in the list, such as a "portrait" plate, a "fine grain" plate, plates made for transparencies and lantern slides, for processs work, for X-ray work, and so on.

Another group will contain the orthochromatic plates, generally supplied in at least two rapidities. Amongst the orthochromatic plates are some known as "non-filter," or "self-screen," or "no-screen," or words to that effect. These are also "panchromatic" plates.

The question will arise in the mind of the beginner, which of all these plates he should select; and he will probably wonder whether, having chosen, say, a "portrait" plate, he can use it also for landscapes, or *vice versa*.

Taking first that of sensitiveness, it should be understood from the very start that the finer distinctions which are often drawn between the sensitiveness, or speed, of one sort and that of another may be ignored in practical work. If we are using the fastest plates made by A, and we go from those to the fastest made by B, we need make no allowance in our exposures, because one box happens to be marked with a speed number of " 250 " for instance, and the other " 350." Exposures cannot be calculated to such a nicety, and, fortunately for us, they do not have to be. We shall be quite safe in assuming that " extra rapid " is about three times as fast as the " ordinary " or " landscape " plate, and that the fastest plate of all is twice as fast as the extra rapid, and, therefore, six times as fast as the ordinary. A subject which, on the fastest plate of all, requires one second to give a fully exposed negative, will give a fully exposed result on an " extra rapid " with two seconds, and on an " ordinary " with six seconds.

If we use an exposure meter of the " Watkins " type, we may send to the Watkins Meter Co. for its card of plate speeds, in which each of the different plates on the market is given, with a speed number attached, which is the speed used in the meter ; but if we have not got the speed card, we shall be quite safe if we assume that the " ordinary " plate has a speed of " 65 Watkins," the " extra rapid " one of " 200 " Watkins," and the fastest of all " 400 Watkins." Roll and cut films may also be considered as having a speed of " 250 Watkins," although as a matter of strict accuracy they would be placed somewhere a little above this, between the " extra rapid " and the very fastest.

For the beginner who uses a hand camera there can be no two opinions as to which speed to choose. He should select a plate of the intermediate kind—the " extra rapid." It will be fast enough to use for snapshot work, but at the same time it will not make the demands upon his skill which are made by the fastest plates of all. It will be cheaper than these also. When he gets more expert he may pay the extra money and get the very fastest, but many workers find that the " extra rapids " will do all that they require.

For time exposures made with the camera on a stand, when there is nothing to be gained by cutting the exposure short, there is a good deal to be said in favour of " ordinary " rapidity. Such plates are to be preferred, on the whole, for copying, architecture, and generally for what is often referred to as " technical photography "—the photography of commodities for catalogue illustration, etc.

It must be remembered that, broadly speaking, the faster the plate the more difficult it is to use. Less light must be employed in the dark room, and the more careful must we be to protect the plate from it as much as we can. Its extra sensitiveness also makes it more susceptible to chemical injury —that is to say, it is more easily " fogged " in development. The slow plates seem to develop up more readily into the kind of negative one likes to get, taking on density more quickly and keeping brighter. It is true that modern improvements in plate making have gone a long way to lessen the differences that existed in favour of slow plates, and there is now not so very much to choose between the fastest and the slowest in these respects. Still, there must be some difference in favour of the slower plate, and this, for work where rapidity is not wanted, would lead to its selection.

Nothing so far has been said as to the choice of a make. One cannot expect a platemaker to admit that his rivals' products are as good as his own, but uninterested parties will not be likely to contend that in the case of the leading manufacturers' products one brand is noticeably inferior in quality to any other. So great is the capital involved in the organization of a successful plate factory, the business of which must depend absolutely upon the confidence of its customers in the character and reliability of its wares, that the utmost care is taken in supervision and testing to minimize the risk of a single defective plate getting on the market.

The particular make selected is therefore of no importance. What is of importance is that the user shall get the plates in as good condition as they leave the factory. The best guarantee of this is to buy from a dealer who turns over his stock quickly. A good plan for the beginner is to find out from his dealer the kind of plates of which he sells the most, and to select those for use. He will then be able to count on freshly made goods all the time. As different makes vary in the way in which they develop, it is wise, having made a choice, to stick to that kind until one is thoroughly familiar with its peculiarities and has mastered its use.

All the various shades of colour met with in Nature have to be represented in the photograph by different depths of the same one tint, usually black or brown. As is well known, some colours " come out " lighter in the photograph than they appear to the eye in the original, and some darker. If we have red and blue flowers, for example, the red, if at all a pure or scarlet red, will photograph as if they were very dark, although to the eye scarlet is a very bright colour ; whereas quite a deep blue flower will photograph ordinarily as if it were nearly white.

The reason for this is that the sensitiveness of the emulsion on a plate or film is different from that of the eye in this matter of colour. The photographic preparation is highly sensitive to violet, blue, and blue-green, not very sensitive to green or yellow, and nearly insensitive to red. On the other hand, the eye is not very sensitive to violet (we should describe it as a dark colour), it is more sensitive to blue, still more so to green, while yellow seems the brightest of all, red showing a falling off.

With many subjects this mistranslation is of no great importance, and at times is actually an improvement. But there are some subjects with which it constitutes a great drawback. For example, it is the main, but not the only, factor in the loss of cloud forms in landscape photographs. The blue expanse of heaven is to the ordinary photographic plate as bright as the whitest cloud seen against it, and we therefore can see little or no difference between the two in the final print. In portraits slight, almost unnoticeable, shades of yellowish-brown on the skin appear much darker than they should do, and so retouching is required, especially when we are dealing with a freckled person. In landscape, again, the photographic emulsion renders most of the green of the foliage too dark, and does not sufficiently differentiate between the various shades of green.

In order to overcome this defect, orthochromatic plates and films were introduced. In these the emulsion has been treated in such a way that it is distinctly more sensitive than before to those colours to which the eye is most sensitive—

green, yellow and orange. It is also more sensitive to bright red, but it is still insensitive to deep red. Later on, " panchromatic " plates were made, sensitive even to the deepest red; and these have now been perfected to such an extent that many experts use them exclusively. All the roll film ordinarily supplied to-day is orthochromatic.

Most plates which have been specially sensitized to render the various colours more correctly have the syllable " chrom " in their descriptive names. Although " orthochromatic " plates (or " isochromatic," for the terms are now used indiscriminately) are more sensitive to green and yellow than plates which are not orthochromatic, they are still quite disproportionately sensitive to blue and violet. So much so, that unless some very special subject is chosen, the orthochromatic plate used by itself does not give a picture perceptibly better than its rival. But by using with it a " colour screen," or " light filter," this can be remedied.

The " colour screen " is made by dyeing a film of gelatine or collodion, generally to a yellow colour, and cementing it between two pieces of glass for protection. It is put somewhere in the course of the light rays before they reach the plate: the most convenient position usually is close to the lens, in front of, in the middle of, or behind it. The dye in the film is adjusted so that it cuts off some of the light to which the plate is disproportionately sensitive, while allowing the rest to pass freely. The combined action of the " colour screen " and of the orthochromatic emulsion gives a photograph in which violet, blue, green, and yellow are represented more nearly in the same degrees of relative brightness as they present to the eye.

In order to bring about this result the " colour screen " must be deep enough. Its use necessitates an increase in the exposure, since it must cut off some of that light to which the emulsion is most sensitive, light which otherwise would go to make the image. It is not always possible to increase the exposure sufficiently to correct the defect entirely; so that colour screens are of different depths to suit varying circumstances. They are generally described according to their effect upon exposure with orthochromatic plates of the average kind. Thus, a " five-times " screen is one which requires the exposure with it to be five times as long as without it. Colour screens must only be used with orthochromatic plates.

In recent years it has become the practice to make plates in which the film itself has been dyed to serve as a colour screen, so that no separate " light filter " is necessary. They are known as " non-screen," " self-screen," etc., according to the fancy of the maker. The screening action of the dye must necessarily be comparatively small, in order not to make the exposures with them impracticably long; so that such plates do not give complete correction, or anything near it. But they give a truer result than orthochromatic plates used without any screen, and one much truer than plates which are not orthochromatic at all. Moreover, there is no reason why a separate colour screen should not be used with such plates should special conditions make it advantageous, provided the exposure is increased accordingly.

There is no great difference between orthochromatic and non-orthochromatic plates in use, except that, owing to their sensitiveness to yellow, orthochromatic plates must be handled more carefully in the dark room. Ruby glass is not at all suitable for them; one of the special " safe lights " should be used. Panchromatic plates, being sensitive to red, are often worked in total darkness, and are hardly material for the beginner; but there is no reason why a beginner should not use orthochromatic plates, " self-screen " or otherwise, from the start, without a separate screen at first, getting one later on should he feel the need for something better in the way of colour-rendering.

Plates can be bought " ready backed "; that is to say, with an opaque compound on the glass side, which in certain circumstances is very useful. I myself have not bought an unbacked plate for many years; and experts are agreed that backed plates never give worse results than unbacked ones, generally give much better results, and in certain circumstances are an actual necessity. But backing costs extra, and the beginner at first is much more likely to think the backing a nuisance than an advantage; so that he may well defer using backed plates until he has reached a stage at which he is convinced of their superiority, and feels the need for them.

CHAPTER IX

Loading the Camera

LOADING WITH ROLL-FILM—WINDING OFF EXPOSED FILM—LOADING WITH PLATES—METHODS OF PACKING PLATES—RECOGNIZING THE COATED SIDE—DUST—PRECAUTION AGAINST LIGHT FOG.

IT is not possible to describe in detail the loading of the camera, since different patterns have to be loaded in different ways: but a few general hints may be given. It is a good plan to get the dealer to explain the instrument as fully as he can, but not to load it. It can then be taken home and carefully examined inside and out in full daylight, so that the photographer may know just what happens when this screw is turned or that button pressed. Not till he has done this should he load it up for use.

If it is a roll-film camera, the instructions given with the film cartridge will be sufficient. A word of caution may be given against allowing the protecting paper to unroll on the spool, and against inserting the taper end of the paper unevenly into the slot in the empty spool. It is well always to load up or change the spools in a place where the light is not too strong, in a room, for example, rather than out of doors, or if it must be out of doors, in a shady place and not in direct sunshine. When the first spool is exposed and has been removed from the camera, it should not be grasped and screwed up tighter, as this may injure the sensitive surface; but it should be kept from unrolling, and stuck down and wrapped up without loss of time.

The question is sometimes asked which is the "top" of a roll-film camera, as the spool and the detachable back are both marked "top." The reply is that it is the side which is uppermost when the camera is being held as it would be in actual use, so that the image can be seen in the finder. After loading the spool into the camera it is important, before putting in the back, to make certain that the protective paper travels quite evenly between the two spools. There need be no fear of unwinding the paper too far—there is an ample length to allow for three or four turns being given without endangering the film. When reeling off the first or any fresh length of film after exposure, the camera, if a folding one, should always be extended, *i.e.*, with its front drawn out. *The film should be rolled off or the plate changed immediately after making the exposure* ; so that this becomes such a habit that it is done almost automatically.

With plates, the loading must be done in the " dark " room, and before actually darkening the room the things required should be placed in order on the table. The packet of plates, if all are not going to be loaded at once, should be opened by cutting through the thick paper in which the box of plates is wrapped with a sharp knife, right across the middle of the top and bottom and down the sides. The paper wrapping can then be slipped off bodily, in two equal pieces, and, if not crumpled up, can be replaced without difficulty. This can be done before darkening the room, as the box and inside wrappings are in themselves a full protection from light.

When the dark slides or sheaths are taken out, the interior of the camera may be dusted. Then the slides or sheaths to receive the plates can be arranged on the table so as to leave the very minimum of work to be done in the red light. If the dark slides are of that common pattern in which the plates are put in from the front, and they do not already contain exposed plates, the shutters should be drawn, not right out, as that might involve fumbling and delay in putting them in again, but far enough to allow of the easy insertion of the plates. One should make sure, too, that the turn-buttons are free.

The dark room lamp can then be lit, and when it is seen to be burning properly all white light may be excluded. The first time anything of the kind is done, it will be well to wait a minute or two at this stage for the eyes to get accustomed to the dim light ; but to do this one must not gaze at the lamp—in fact, it will be better to turn its face away, so as to leave the table in shadow.

Unless the blocking out has been very carefully done, after a minute or two in the semi-darkness, rays of white light from unsuspected openings will be seen. In theory all these should be blocked up, of course; but in practice if the holes are small ones—such as a keyhole, for example—and are so placed that there is no possibility of the light which enters by them shining directly on the plates or some reflecting surface near the plate, no harm will be done. At the same time, it is well to remember that any scattered white light in the room shortens the total time during which a plate can be left uncovered without any risk of fog.

On opening the box of plates, it will be found to contain one or more packets, and the particular method of packing that is adopted by the maker should be noted, because this is always the same as far as that maker is concerned, and so when once learnt it becomes easy to do the loading in complete darkness, which is the course followed by most expert workers, and has much to recommend it. The beginner may look at the plate to see which is the coated side; but this should soon become unnecessary. There is a distinct difference, even in the red light, between the coated and the uncoated sides. One has a beautiful, even, opalescent look—this is the face; the glass side seems darker as a whole, but more highly reflecting.

Some plates are wrapped in pairs, a few in sixes, but the majority in packets of four, and it is invariably the case that each two plates are put face to face, so that, the glass sides being outwards, the delicate film is protected. Little cardboard separators are generally used at the edges to keep them from actual contact.

A method sometimes adopted with small plates is to make them twice the size of the plate and to cut the glass in half, but to leave the film intact. The two plates are then folded together like a book, the film acting as a hinge. On unpacking such a pair of plates, if they are opened quickly, as one would open a book not caring whether the back was broken or not, the film splits and the two plates separate.

It is of the utmost importance never to touch the film side of a plate with the fingers; however clean they may be, a mark will show on development. One must learn to handle plates entirely by their edges. There is no need to dust the surface of the plate; there is sure to be no dust on it when it is unpacked, and dust must be kept off it, not wiped off. The gelatine has electrical properties, and any light dusting of its surface causes it to be electrified, and so to attract any dust there may be in the air.

No more than one packet of the plates should ever be opened at a time, and it should be left where the light does not shine on it. The lid of the box can be used as a temporary cover. Holding one plate by its edges, it is put into the dark slide or sheath, all this being done in a position where the direct light from the lamp cannot reach it. Some workers put the lamp on another table behind them, so that the loading is done in the shadow of the body.

When the plate is in, and before closing the shutter or putting the sheath in the camera, one may just glance at its surface in the light of the lamp, to make quite sure the coated side is outwards.

When all the plates which are to be loaded are in place and protected, the remainder, if any, are wrapped up and the box closed; and only when this is done can white light be admitted. If there is a plate over in the packet without a companion to go film to film with it and protect it, the best thing to do is not to wrap it up at all, as the brown wrapping paper in contact with the film might affect it. Even putting it down on the glass side of another may injure it. I have known bad cases of finger marks transferred to a plate in this way. If the packets when duly wrapped up are put back in the box, the odd plate can be placed face upwards on top of them, and the box will usually be found quite an efficient protection, especially if its outer wrapping paper is replaced. The wrapping should be fastened with a gummed label, or in some similar way, to indicate that the box contains sensitive plates, and to prevent it being opened accidentally or by some curious person.

It may be thought that all this care to avoid exposing the plate even momentarily to light is unnecessary. There are photographers who work on a bench on which the red lamp shines all the time, and yet get perfectly clean negatives. But then they have to use a form of light in which seeing anything that is not close up to the lamp is difficult and their work necessarily suffers from being carried out under such conditions and hurriedly. The dark room light should be bright enough to enable any printed instructions to be read with comfort. If anything is wanted from another part of the room it can be seen, not groped for, and there will be a minimum of breakage and loss due to working in a feeble illumination. The comfort of plenty of light is well worth the little extra care. The light is used to see by ; it should therefore only be allowed to reach the sensitive material during the very brief moments when it has to be seen. There is a limit to the exposure which any plate can receive without injury, and the more careful we are during the preliminaries, the greater will be the margin left to be utilized when it may be actually necessary—that is to say, during the development.

In all work with a lamp, the illumination decreases with the square of the distance from the lamp, so that a plate one foot from the lamp will be as badly fogged in ten seconds as it would be in ninety seconds at three feet, or in six minutes at six feet. This is as far as direct light is concerned. Light reflected from the walls and other objects in the room, with any reasonable kind of dark room lamp at all, has been weakened down from the combined effects of distance and absorption until it has become harmless.

CHAPTER X

Fixed-Focus Cameras

THE MEANING OF FIXED FOCUS—THE INFINITY POINT—FOCUSSING WITH MAGNIFIERS—THE EFFECT OF THE MAGNIFIER ON EXPOSURE—DEPTH OF FOCUS AND MAGNIFIERS.

WHEN using high-class lenses upon cameras of quarter-plate size, let us say, or larger, and working at a large aperture, the focussing has to be very carefully done. With an anastigmat at f/6 the slightest movement of the ground-glass can be seen to be sufficient to destroy the definition; whereas with a lens working at, say, f/11 or f/16, a similar movement might make no perceptible difference at all. Hence it follows that it is not sufficient to buy a costly instrument to bring about an improvement in one's work: we must use it properly. If we do not, the fine lens may actually mean that the work done is worse instead of better.

As a clear, distinct picture depends so very largely upon the way in which the focussing has been performed, it will be well to go into this subject a little more closely. And first, we may note the methods of focussing.

In the simplest form of camera, as we have seen, there is no arrangement for focussing at all. The film or plate is at one fixed distance from the lens, decided by the maker of the apparatus, and it cannot be moved. The only way such cameras can be focussed is by the use of what are called "magnifiers." Then there is the type of camera in which focussing is done by scale, the photographer estimating or measuring the distance of the object which he wishes to get sharp, and setting a pointer to that distance marked on the scale. Finally there is the reflex and the ordinary stand camera, in each of which there is a ground-glass focussing screen, on which the image formed by the lens can actually be seen, and the focussing screw turned until that image looks at its sharpest.

We will take these in order. Some seem to think that the fixed-focus camera is something entirely different from the others, and that there is merit in the fact that it does not require any focussing. But this is due to a misunderstanding. Any camera can be made a " fixed-focus " camera, as has already been pointed out, by the simple expedient of opening it out to a certain point and leaving it there ; it will then work in every way exactly as does a camera of fixed-focus type.

A fixed-focus camera, then, is not one by which all necessity for focussing has been done away with, but merely one in which no provision for focussing has been made, whether the photographer wishes to focus or not. And it cannot be put too emphatically that, however much the beginner may be struck by the apparent advantage of " fixed focus " he will have done very little photography indeed (unless he is working one of the very small sizes) before he finds himself anxious to photograph some subject which can only be dealt with successfully by means of a camera with some means for focussing.

To understand the nature of a fixed-focus camera we must first note why it is necessary to focus at all. We have seen (Chapters III. and IV.) that for each distance in front of the lens that an object may be, there is some distance behind the lens at which the plate or film must be placed, in order that the image formed by the lens may be sharp, and that the nearer the object is to the lens, the further from the lens must we have the plate or film ; while, up to a certain point, the more distant the object, the closer to the lens must the plate or film approach.

If we were to place some object very near the camera, say, for example, only two feet in front of the lens, and focus the image sharply on the ground-glass screen, and if, having done this, we were to move the object until it was not two feet, but three feet away, we should have to bring the ground-glass appreciably nearer to the lens, in order to get the image sharp once more. With a quarter-plate camera, we might have to move the ground-glass by as much as two inches to do this. If we then moved the object another foot farther away, we should find that, although we had once more to bring the ground-glass nearer to the lens, this second foot did not call for as great a movement as two inches. We might only have to move it about an inch. If we again moved the object a foot further away, the movement of the ground-glass required to bring the image sharp is still less, say about half an inch, and with a further foot it is only about a quarter of an inch, and so on until we very soon find that the movement of the ground glass to accommodate the focussing to an extra foot in the distance of the object is negligible. When once this distance of the object has been reached we can move the object as far beyond that distance as ever we like without its image being made appreciably less sharp thereby, or requiring re-focussing. This holds true up to any distance whatever. If we could photograph an object at an infinite distance from the camera it would still be sharp.

Therefore, when the camera has its focussing screen at such a position that it requires no further adjustment for any increased distance of the object, we say it is "focussed for infinity."

In cameras fitted with a focussing scale this point is usually marked "Inf.," but sometimes it is indicated thus ∞ this mark, which is something like a figure 8 lying on its side, is the mathematician's symbol for "infinity."

To take some definite case, we will suppose that we have found that when, with some particular lens and its largest stop, the image of an object at nine yards distance is sharp, we can move that object as much farther away as we like without making its image any less sharp; then it is obvious that if we leave the focussing of the camera alone thereafter, or if we fix it in that position with a screw or nail, or if we make a mark on it so that at any time afterwards we can extend it to precisely that position, we have a camera with which we can photograph all objects, provided they are not less than nine yards from the camera, without any further focussing at all. So that we shall have turned a focussing camera into one of fixed focus.

Some may think that if only lenses could be made that would reduce the distance beyond which all objects are sharp to a point which was fairly close to the camera such lenses would become very popular. If, for example, we could make a lens which required no re-focussing for anything more than a yard away, we should do away with the trouble of focussing almost entirely, for it would be very seldom indeed that we should require the object within a yard of the camera. Nothing could be much easier than to construct such a lens.

If the photographer possesses any photographic lens at all, no matter what may be its pattern, or its quality, or size, he can arrange quite simply that it shall need no focussing at all, and will give a perfectly sharp image of everything that is more than a yard away. But in all these matters we have to adopt compromises. If we wish to get so great an advantage as this in one direction, we have to pay a high price for it in another. It is not a pecuniary price in this case, but it is one of great importance, especially to the hand camera worker: it is paid in rapidity.

The smaller the stop in the lens the nearer can we bring the point beyond which everything is in focus. For instance, if we have a lens that will work at f/5.6, we may find that the nearest point to which an object can be brought, and still be sharp at the same time that everything beyond it is sharp, will be twelve yards. If we stop down to f/8, however, that distance is reduced to nine yards, at f/11 it is six yards, at f/16 it is four yards and a half, and at f/22 it is only three yards, and so on.

There is another factor, however, which also comes into play, and that is the focus of the lens. The shorter the focus of the lens, the f/- number of the stop remaining the same, the nearer will be the point beyond which everything is in focus. For example, if we examine a number of lenses of different foci, all working at f/8, let us say, we shall find that with a 4½ in. focus lens seven yards may be the distance beyond which everything is in focus ; with a 5 in. lens the distance is increased to nine yards, and with a 6 in. lens to twelve yards. Hence it comes about that cameras taking very small sizes, and fitted, as they usually are, with lenses of very short focus, simplify the focussing problem very much ; they may even do away with it entirely.

It is clear from these facts, which apply to all from the simplest single lens to the most elaborate and costly anastigmat, that a fixed focus camera to be of much use must either have a lens that works at a comparatively small stop, or else one of very short focus. Short focus lenses are not of much service except for pictures of a very small size; quarter-plate (4¼ × 3¼ in.) is about the largest that is practical for working at fixed focus, and even that has great limitations. For instance, a quarter-plate fixed focus camera requires its lens to be stoppped down to f/16, or to f/11 at the largest, to be really usable in this way.

It will be understood now how it comes about that in such sizes as quarter-plate, fixed focus cameras are very seldom fitted with any but the cheapest lenses. The great merit of the more expensive lenses is that they can be used at a large aperture; and, as the adoption of the fixed focus principle compels us to use a small aperture, there is little to be gained by having the more expensive lens. In very small cameras of the " vest pocket " type the lenses used are much shorter in focus, and so can be used at fixed focus with a larger stop. Hence on these tiny instruments one often sees a high-class anastigmat lens; because, in spite of the fixed focus, we can use it at a large aperture.

There is no reason why a beginner should not purchase a camera of this kind, if he does so with his eyes open. I mean by this if he recognizes that " fixed focus " is not an advantage or merit, which will make his photography simpler; it does not do that, in spite of the fact that focussing does not have to be done. It is essentially a limitation which, for financial reasons, he may decide to impose upon himself. He may be quite certain, as I have said before, that the time will soon come when he will wish he had no such limitation, and will feel that the larger aperture of lens, and the increased scope which it gives his work, would more than repay him for the trouble of having to focus his picture before he proceeds to take it. The fixed focus stage may very well be a stage in one's photographic career; but if anything beyond the most elementary work is to be done it will soon be left behind.

It has been pointed out that the only way by which a fixed focus camera can be focussed is by the use of " magnifiers." A " magnifier " is a supplementary lens, attached to the original lens of the camera for some special purpose—usually, but not always, for focussing. In its cheapest form, the magnifier is merely a single glass or spectacle lens. But there are magnifiers on the market which consist of two glasses, cemented together so as to form a "single combination." Such a combination is "achromatic," and may reasonably be expected to give an image with better definition than the other kind, although in actual practice the difference is slight.

A "magnifier" is generally what its name implies—a magnifying glass or "positive" lens—a spectacle lens of the kind used by far-sighted or old people. For certain purposes, however, it may be the other kind of lens, a diminishing glass or "negative" lens, such as the spectacle lenses used to correct short sight.

When a magnifier is being used for focussing purposes, it is performing exactly the same function that it does in the spectacles of a far- or short-sighted person, as the case may be. Anyone with far sight has eyes comparable to a fixed-focus camera with such an extension as gives a sharp image of distant objects, but an indistinct one of near objects. The person with vision of this type who wishes to see something close at hand more clearly, provides the lenses of his eyes with magnifiers in the shape of a pair of spectacles; and the combination of the lens of the eye with the magnifier forms a compound lens of shorter focus than before; so that the near objects, which were formerly seen only in an indistinct or blurred manner, are now sharply focussed on the retina.

Just as it is important for good vision that the spectacles should be as near as convenient to the eyes, and the eyes should look straight through the centre of them, so should the magnifier be set on the camera as close as possible to the camera lens, and strictly central with it. In the majority of cases the magnifier is put in front of the camera lens, that is to say, between the lens and the object; but, in certain circumstances it may be put behind it, and, within limits, the effect is the same. It is important, of course, that it should be quite clean and free from dust, but, just as with the camera lens itself, the magnifier should be kept where dirt cannot get to it, rather than be frequently rubbed.

The lens in the camera, regarded as a whole, is a positive lens, as can be seen at a glance, if it is removable, since when held in the hand, it acts like any other magnifying glass. A magnifier that is also a positive lens, added to the camera lens, forms a combination which is of shorter focus than either the camera lens or the magnifier taken by itself. It is upon this fact that the use of the magnifier for focussing is based.

This can be made clear by taking an actual example. We will suppose that we have a fixed-focus quarter-plate camera with a lens of six inches focal length ; then, for distant objects to be sharply defined, the plate in such a camera is fixed, once for all, six inches away from the lens. If we try to photograph some object only three feet from the camera, we shall get a blurred picture, because—as can be found by a simple calculation, about which we need not trouble further for the moment —for a six-inch lens to give a perfectly sharp image of an object three feet away, there must be a space not merely of six inches such as we have, but of a little more than seven inches between the lens and the plate.

A similar calculation will tell us that to get a sharp image of an object three feet from the camera, with a space of six inches between the lens and the plate, we must employ a lens not of six inches focus, but of a focus of five and one-seventh inches. So that in such a case we should have to employ a magnifier that, when applied to a lens of six inches focus, will give with it a combination having a focus of five and one-seventh inches instead of six inches. In the same way, if we wished to get an object at five feet from the camera quite sharp, we should have to use a magnifier that, with the lens in use would give us a combination with a focus of approximately five and a half inches focus.

The magnifiers, which are supplied all ready mounted to fit on the camera, are generally known by the distance of the object which they will give in focus when fitted to the camera lens. Thus a four-foot magnifier gives a sharp image of an object four feet away. But they are sometimes described by the nature of the work for which they are used. Thus a " portrait magnifier " will give a sharp image of an object about four feet from the camera, which distance will be about right for a head and shoulders portrait ; and a " copying magnifier,'' which gives a sharp image of an object nine or ten inches from the camera, will yield a copy the same size as the original.

There is no reason why the photographer should keep to the magnifiers which are supplied for that special purpose. He will find that ordinary spectacle lenses, put up in some simple home-made mount, will do just as well. As a rough guide, he may remember that to give a sharp image of an object at any particular distance from the camera the focus of the magnifier should be the same as the distance the object is to be. Thus a magnifying glass of eighteen inches focus, applied to the ordinary fixed-focus camera, will cause the image to be sharp if the object itself is eighteen inches away. If he does not know the focus of his magnifier, he can find it with sufficient accuracy by using the magnifier as a burning-glass, and measuring its distance from the spot of light forming the image of the sun, when this spot is in its most concentrated form.

Magnifiers generally being nothing more than simple uncorrected lenses, they are bound to affect injuriously the character of the definition obtained. The image with a magnifier attached is not quite so sharp as that given by the camera lens without it—at any rate in theory. In practice, as the lenses in such cameras are themselves usually only very simple forms, although not entirely uncorrected, and the magnifier is a comparatively weak form of lens, its use does not make any perceptible difference to the definition. It is better, all the same, to use a smaller stop when the lens is coupled with a magnifier, if the work is such that the increased exposure is not any detriment.

This brings us to consider the question of exposure as it is affected by a magnifier, and here it may be said at once that, when a magnifier is used with a fixed-focus camera, the exposures given are not affected, so far as the influence of the magnifier itself is concerned. Why this should be the case is easily explained.

The lens affects the exposure, as already pointed out, according to the relationship between the diameter of the opening in the stop and the focal length. For exposure purposes we may take the focal length as being the distance between the plate and the lens—the camera extension, in other words. The magnifier does not alter this—in fact, it is used expressly so that we need not alter this. Moreover, if the magnifier is large enough, it does not affect the size of the aperture in the lens. So that although, nominally, the magnifier has been used to change the focus of the lens, as we have seen, actually the aperture and the focus remain the same, and the exposure does not have to be altered merely because a magnifier is in use. But as the magnifier is used in order that we can photograph objects near the camera, and as such objects generally have heavier shadows than are to be found in more distant objects, it will happen that in most cases in which a magnifier has to be used the exposure must be increased. The exposure is also affected directly by the magnifier when this is used, as it sometimes is, for quite another purpose on focussing cameras, but this need not concern us here.

No magnifier will enable us to get a sharp image of a near object and at the same time get the distance sharp too. If the camera is set to give distant objects in sharp focus, the addition of a magnifier will throw the distance out of focus, while bringing into focus near objects which previously were blurry. If we desire to get both near and distant objects sharp at the same time, either we must stop down or we must add a magnifier and stop down as well. Whether one or both will be required will depend on circumstances, and must be ascertained by trial, if the photographer has not already experience enough to tell him what to do.

Magnifiers form a cheap and simple method of focussing near objects with fixed-focus cameras, but at best they are only makeshifts, and cannot be a complete and effective substitute for a proper focussing camera. For instance, they allow of no intermediate stages of focussing. A two-foot magnifier is correct for objects at two feet ; but if we wish to photograph objects at eighteen inches, or at three feet, then we must get additional magnifiers to work at such distances. With a focussing camera, any and every distance can be dealt with simply by adjustment of the camera itself, and no magnifiers are required.

With highly corrected lenses working at a large aperture, magnifiers are not very suitable, as they might then perceptibly degrade the quality of the definition. They are only effective on the comparatively slow lenses fitted to the cameras of fixed-focus type.

There is another objection which can be raised to them for certain purposes. This applies particularly to the case of portrait magnifiers. To get a head and shoulders portrait the magnifier requires the camera to be within three or four feet of the sitter, and at such a distance the perspective rendering is not very good—we shall get what is called a wide-angle effect. It is far better in such a case to be satisfied with the smaller picture obtained at a greater distance without the magnifier, and, if a larger image is wanted, to enlarge the head and shoulders only from the resulting negative.

CHAPTER XI

Focussing

FOCUSSING WITH A SCREEN—FINDING THE STOP TO USE—FOCUSSING BY SCALE—ESTIMATING DISTANCES—CHECKING THE SCALE—ALTERNATE SCALES FOR FILMS AND PLATES—THE INFINITY CATCH.

FOR purposes of explanation it will be better to take first the type of camera which has a ground-glass focussing-screen, partly because what has to be said about it will help to throw light on the topic of focussing by scale, and partly because a very great many of the cameras which focus by scale also have a ground-glass focussing screen, or can be fitted with one.

We have seen that the nearer an object is to the camera the greater must be the distance between the ground-glass and the lens for the image to be sharp ; we have also learnt that as the object is nearer and nearer to the camera, so does the necessary extension of the camera increase.

The distance of the object from the lens determines the scale of the picture, so that if we wish to show something on a large scale, it must be quite near the camera, and, consequently, the ground-glass must be a long way from the lens. For instance, if we have a quarter-plate camera of the ordinary kind, we shall find that, to photograph something twenty or thirty yards away, the distance of the ground-glass from the lens will be something less than five inches ; whereas if the object is so near that its image in the photograph is the same size as the original, the ground-glass will have to be from eight to ten inches from the lens.

It is evident from this that for work of this latter description the camera must be one that can be opened out a good deal beyond its ordinary extension. There is therefore a very distinct advantage about having plenty of extension to a camera, unless the photographer is in a position to have two instruments—one a single extension for hand camera work pure and simple, and another, which may be heavier and without any of the costlier hand camera fittings, for work on a stand at home. This latter should be provided with a " double " or, better still, a " triple " extension.

Ample extension confers another advantage. As already mentioned, many of the lenses in general use for photography are so made that one of the glasses, or sets of glasses, of which they are composed can be unscrewed, leaving the other in position. The part that is left can be used by itself, giving us a lens nearly twice as long in focus as the complete instrument. There are times when such a long focus lens is very useful, for it will give us an image of a distant object nearly twice as large as the image given by the whole lens, without having to move the camera any nearer the object to get such a result. In order to be able to focus with the half-lens, we shall require a good deal more extension than the complete lens requires. A double-extension camera should open out far enough to enable half the lens ordinarily fitted to it to be used, even for objects which are not more then a few yards away.

Focussing with a screen is done by observing on the ground-glass the appearance of the image as the camera is racked in or out. The ground surface of the focussing screen is turned towards the lens in almost all cases (one or two reflex cameras have the ground surface outwards, for a reason into which we need not go), and the sensitive emulsion on the plate or film is also turned towards the lens at the time of exposure. It is absolutely essential, if the image in the photograph is to be as sharp as the image which we see on the ground glass, that the coated surface of the plate or film shall occupy exactly the same place as the ground surface of the focussing screen. This is called being " in register."

All the leading makes of camera are made in quantity by machinery so accurately that one may take it for granted that if the ground-glass is in its proper position it is in register with the plate in the dark slides or holders supplied with the camera. But if dark slides of another make were to be used, it would become important to be quite sure before using them that they are in register, or, if not, that they are altered until they do register.

An opaque cloth of ample size should be provided for use with every camera with a focussing screen. It need not be of velvet, which is heavy and clinging, and may disarrange the hair. A couple of thicknesses of black sateen make a very good cloth, or a single thickness of a waterproof cloth can be used, which also provides a protection for the camera if we happen to be caught in a shower.

When focussing any subject the largest stop of the lens should be used at first, only resorting to a smaller one when it is evident that the largest will not give the definition required. Unless the subject is in every part at a good distance from the camera, or else is a perfectly flat one, such as an engraving or other printed sheet, and the lens is a high-class anastigmat, it will not be found possible to get every part of it in sharp focus at once with the largest stop.

Let us suppose, for example, that it is a landscape we are focussing, with a foreground of foliage only three or four yards from the camera, and a glimpse of distance that may be a quarter of a mile away or more. If we rack the camera in and out until the distance is quite sharp, and then examine the foreground, we shall see that it is blurry, while if we focus the foreground the distance is not sharp. What, then, is to be done ?

The problem is to find the largest stop that will give the definition which we require, and the position of the focussing arrangement which suits it. In doing this it must first be noted that perfectly crisp definition over the whole of the picture may not be absolutely necessary.

In making this observation I am not supposing that the photographer is an advocate of what are called "fuzzy" pictures ; but that he wishes to get a picture that shall not appear to be otherwise than perfectly sharp, although he is not fanatically anxious for definition that no one will notice or appreciate. Now, as we have already seen, while the eye demands good definition in the objects right in the foreground of a landscape, it does not require such fine definition in the more distant parts. These can be blurrier than the foreground without the want of absolute sharpness being noticeable.

As almost all focussing is a compromise, we can take advantage of this fact.

Accordingly, with the full aperture of the lens, we proceed first to focus the distance. To do this the focussing screw is turned backwards and forwards, a little less each time the movement is repeated, until the point is found at which the distance appears quite sharp. As the foreground is nearer to the camera than is the distance, the extension of the camera will be greater when the foreground is sharp than when the distance is sharp. So, having focussed the distance, we proceed to rack out the camera very gradually, watching the image of the distance on the ground-glass, and stopping as soon as we feel that we have gone as far as we can without making that distance too unsharp. Having done this, we may look carefully at the foreground on the ground-glass.

It may be that in racking out the camera in this way we have made the foreground sharp enough, in which case there is nothing more to be done but to make the exposure. But we must be quite sure on the point, as any want of definition there will probably be much more in evidence on the finished photograph than it is on the focussing screen. We must hold the focussing cloth so that it makes a dark tunnel, down which we look at the ground-glass, and moving the head about, so as to bring the eyes opposite each part of the focussing screen in turn, we must see that even in the darkest corners the definition is what it should be.

If the result of this trial shows that we cannot get the foreground as sharp as we want it without making the distance more blurry than we care about, then we must try a smaller stop. To do this we focus the distance again, set the diaphragm to the next largest opening, and rack out the camera as before until the distance is as far from sharp as we can tolerate. It will be found that, as we have stopped down a little, we can rack out the camera farther before this stage is reached. If that does not do it, then we can focus the distance, stop down a little more, and repeat the operation. This sounds an elaborate procedure, set out like this in black and white, but the actual work usually takes at the most a minute or two.

The focussing of a portrait is carried out in much the same way. It is even more important in this case than in that of a landscape to use the largest aperture that we can, in order not to have to keep our sitter motionless for longer than is necessary. In portraiture, the sharpest definition is required on the face. The nose, eyes, and lips must be as sharp as we can make them ; if the ears and hair are not quite so sharp, the want of definition may go unnoticed, while, as for the background or setting of the portrait, a want of sharpness may be a distinct advantage. It helps to concentrate attention on the sitter. If we have a plain background, then no degree of blurriness can matter as far as that is concerned.

The principles in all focussing are the same. Except in those cases in which the same crisp character of definition is required all over the picture, it is best to focus first on the part that does not have to be absolutely sharp, and then to rack the camera in or out, as the case may require, until that part has departed as far from complete sharpness as we can put up with, noting whether, when this point is reached, the parts that are required quite sharp are in that condition. If not, the next size of stop is inserted and so on.

In this way the photographer will get into the habit of using the largest stop that will give him what he wants, which not only enables him to work with the shortest exposure, but brings with it other advantages. It is at least much better than the slovenly habit of using a needlessly small aperture to save the trouble of focussing properly.

Having seen how the photographer focusses his picture by means of the ground-glass screen, we may now deal with focussing by scale. Before passing on to do so, however, it should be observed that whenever it is practicable the ground-glass should be used. The photographer who is only provided with a camera which focusses by scale and is not furnished with a focussing screen, will find himself very seriously limited, and it will not be long, if he is at all keen on getting the best results he can, before he determines to obtain a more generally useful outfit. Not only is it impossible to focus as well by scale as by a ground-glass, but there is the advantage of seeing on the ground-glass the full-sized picture, and of arranging that picture so as to include just what is wanted.

For hand camera work the ground-glass screen cannot be used, unless the camera is of the reflex type. This form of instrument is costly, for it is necessarily elaborate in design and calls for good workmanship; many photographers have to be satisfied, therefore, with a hand camera focussing by scale.

The use of such a camera necessitates some power of estimating distances with reasonable accuracy, but this is not as hard as it might seem. The real trouble in focussing by scale is very seldom an incorrect estimation of the distance; but the impossibility of seeing to what extent the parts of the picture at other distances than that of the object focussed are sharp. There is no satisfactory way of doing this without a ground-glass focussing screen. We may realize that this or that part of the subject will not be as sharp as the part focussed; but there is no reliable guide to the degree of difference in sharpness. The ground-glass shows us all this, definitely and precisely.

The task of estimating distances is made all the easier because it is only very short distances that we shall ever have to gauge with any accuracy. When our subject is only two or three yards from the camera the distance must be correct to within a foot, and it is often possible to do this by actual measurement; whereas when it is ten or twelve yards away, an error of two or three yards in the estimate is not likely to have any serious result.

The power of judging distance can be learnt with surprising ease by anyone who cares to take the trouble; but most beginners are in too great a hurry, or are not sufficiently methodical or painstaking to set about the task of learning to do so. They are content to pick it up as they go along, and do so, more or less, but at the cost of wasted materials and wasted time. Experience has taught me that it is of little use to recommend any other course, so that I will content myself by putting on record my opinion that a couple of friends, who spend only one afternoon, in the course of a country walk, amusing themselves by a competition in judging distances, will be able at the end of it to do so more quickly and accurately than the average amateur has learnt to do in six months' work with the camera at the expense of who knows how much in time, material, and disappointment. Distances greater than, say, twelve or fifteen yards need not be considered, and after each estimate the actual distance should be measured there and then to see how near was the result.

Some of the scales on cameras are graduated in feet, some in yards, and some in metres. A metre is approximately forty inches, and the photographer who has learned to use a scale in yards will have no difficulty in working with one in metres; in fact, it is generally quite near enough to treat them as equal. On the whole, yards are more easy to work with than feet, but most workers seem to adopt the "length" in actual estimating, looking on the ground which lies between them and their subject, and, making a rapid mental note of the number of times their own height is contained in the distance.

It is well, when setting the scale, to take care to leave it a little on the short side. That is to say, if we estimate the distance at, say, four yards, the index may be put to a point on the scale a little on the "three" side of the four yards mark. One reason for this we have already seen. Any imperfection in the definition is always much more noticeable in objects that are near than it is in the more distant parts of the picture. It is well, therefore, to allow for this by taking care not to focus on a point that is too far away. A fault often found in snapshot work is that the distance is quite needlessly sharp, while the foreground object, which was the real reason why the photograph was taken at all, is indistinct.

There is another reason for this, which calls for a word or two of explanation. If we focus, by the help of the ground-glass, as carefully as we possibly can, on some object fairly near the camera, say three yards from it, and then observe the rest of the picture, we cannot fail to notice the following peculiarity, provided the subject comprises a sufficient range of distances to demonstrate it. The object three yards away on which we focussed is, of course, at the maximum of sharpness, but this sharpness extends also to parts of the subject both nearer and more distant than three yards. The actual extension of fine definition will depend on the focal length of the lens and the stop employed, but whatever these may be, there is always some margin. For example, we may find on focussing for three yards that an object four yards away is also not perceptibly less sharp, and that another object eight feet away appears equally sharp.

The extension over which this apparently equal definition prevails, however, is not equal on both sides of the distance on which the focussing is done. It always extends farther on the side away from the camera than it does on the side towards the camera. Put another way, there is more depth of definition on the farther side of the point actually focussed on than there is on the nearer side. A very slight over-estimate of the distance, therefore, may put us wrong, by causing the foreground objects to be thrown out of focus; whereas an equally slight under-estimate of the distance might have no ill effects at all.

It has been explained that in focussing with the ground-glass the best general definition is obtained by first focussing the distant parts of the subject, and then racking out the camera until the distance becomes as blurry as is allowable. In focussing by scale we have to aim at a similar result.

In setting a camera it is a great convenience to have an index, or pointer, that comes close down to the surface of the scale. In some cases there is a knife-edge, almost touching the scale, which allows the focussing to be done very accurately indeed; but some cameras are very inconveniently made, the point of the index being sometimes quite a quarter of an inch from the scale. The consequence of this is that we have to be very careful to have the eyes exactly over the scale, or we shall not be able to set it properly, in consequence of what is called "parallax."

There are certain types of camera which are provided with two scales, generally distinguished by the letters "F" and "P." In others a single scale can be moved so as to occupy one of two positions, similarly marked. The need for this arises from the fact that such cameras are constructed for use with roll-films on the one hand, and with glass plates or cut films in dark slides on the other. As the design of the camera does not allow the sensitive surface in the case of a roll-film to occupy the same position as the sensitive surface of a plate or cut film in a dark slide, two focussing scales or their equivalent must be used. For roll-film work, of course, the scale must be in the position marked " F," and for all dark slide work in that marked " P." It will be obvious that in such cameras, which usually can be fitted with a ground-glass for use with the dark slides, the ground-glass screen cannot be used to check the focussing scale for " F," but it can be used to see that the " P " scale is accurate. The two scales should be exactly alike as regards the spaces between the different graduations, the only difference being that the whole scale is slightly shifted.

When a camera has two focussing scales separated by a very considerable interval, one is intended for the complete lens and the other for the lens with one-half (generally the front half in such a case) removed. The scale for the complete lens is that one which requires the less extension of the camera.

A very useful feature of most folding hand-or-stand cameras is that which is known as the " infinity " catch. We have seen already the meaning of the " infinity focus," and have learnt that when the camera is set to that point we know that everything beyond a certain distance is in focus. The infinity catch is constructed so that as the camera is opened out the front is caught and held in the " infinity " position ; so that we can use such a camera as a fixed-focus camera, still keeping in reserve the power to focus the picture if we wish to do so.

Although in most cameras fitted with a focussing scale the focussing is done by racking either the front or back of the camera in or out, there are exceptions. In some the lens is mounted in what is called a " focussing jacket," which is provided with a screw thread, so that on turning the lens it moves in or out of its jacket. A scale is provided on the lens mount, graduated in the same way as the ordinary scale on the baseboard and used in the same way also. In another form there is also a scale on the lens mount, but in this only a part of the lens moves, the effect of this being to modify the lens so that it forms a sharp image of objects at the distance for which the scale is set.

On the whole, the most convenient type of focussing scale is that which is on the baseboard, the graduations being visible as we look down upon the finder. The focussing jacket generally involves having the scale on the front of the camera, which has therefore to be turned towards the user before he can see whether the scale is correctly set or not. This is sometimes inconvenient, but as such lenses are generally fitted where the ordinary type of focussing scale is not practicable, we have no choice. There is just this about the scale on a focussing jacket : we may be sure that it applies to the particular lens bearing it, whereas there are cases in which the lens of a camera has been changed without the scale being changed, with results that were very disastrous until the fault was discovered.

CHAPTER XII

Arrangement of the Subject

SUITABLE LIGHTING—THE DISTANCE OF THE CAMERA FROM THE SUBJECT—MAKING THE EXPOSURE WITH A CAP—EXPOSING WITH A SHUTTER—A CAUSE OF POOR DEFINITION.

I WILL suppose the reader to be the possessor of a camera, some extra rapid plates or roll-films, and anxious to take a photograph. It remains to select a suitable subject ; and this is the point on which it is very likely he will bestow too little consideration. He attaches much importance to the form of camera he is using, to the selection of plates, to the formulæ for development, and so on, but does not always realize, until failures have taught him, how very large a part is played by the selection of a suitable subject—a term which may be taken as including not merely the choice of the object itself which is to be photographed, but also the choice of aspect or point of view, and of lighting.

Waste of materials should be avoided, especially when disappointment comes in its train. No exposures should be made without reading carefully the instructions given and familiarizing oneself with the apparatus and its handling. It is hard to curb one's impatience to make use of a new possession, especially one which has the powers of the camera, but, believe me, it is wise not to be in too great a hurry. I have known a beginner make a dozen exposures on his way home with his camera, with no result beyond twelve failures which were complete wasters. I add that they were wasters, because failures are not wasters if we can profit by them. The first dozen exposures might teach us more about photography, if they were failures, than we could learn from a dozen successes ; but, to turn them to good account, we must have been working by rule and not haphazard.

It is possible that when the camera was bought the photographer intended to use it chiefly for portraiture ; but he will do well not to make his first experiments with a living sitter, but with some inanimate objects which cannot become impatient or critical. The house in which he lives will serve, and if the result is a success, he will have a photograph that will have its interest apart from the photography itself.

Very much of the success of a photograph depends upon its lighting. Lighting in this sense does not mean the strength of illumination. Non-photographers seem to think that as photography requires light to be possible at all, the more light there is the better. We often hear it remarked that tropical countries must be fine for photography, " because the light is so good." As a matter of fact, the reverse is the case. Britain, with its moisture-laden air and cloudy skies, is at least as suitable as most countries for successful photography ; and by successful photography I mean bright, sharp, distinct photographs, not " fuzzytypes." The clouds and the atmospheric conditions generally in these islands cause the shadows of the subject to receive more light than they get under blazing sunshine with cloudless skies, and this lighting of the shadows is a great help.

Illumination refers to the direction from which the light is coming, and the character of its source. To get a good representation of any solid object, we must photograph it so that the picture shows parts that are in full light and parts that are in shadow. To secure this in daylight, the camera must be so placed with reference to the subject that the light comes from somewhere behind the camera, but it is well not to have the sun immediately behind us when we photograph. For if the light comes from immediately behind the camera, it will fall on all those parts that we can see, and the parts which are in shadow will be those that are turned away from the eye and from the camera. If the position were exactly reversed, and the object were between the source of light and the eye, we should be no better off, as in that case we should only see the shadow side of the subject—the lights would all be on the opposite side.

Accordingly we choose such a position for the camera that we can see both lights and shadows—that is to say, one in which the sun or other source of light is well to one side or the other. For purely photographic reasons, which will appear subsequently, the sun should be a little behind the camera, so that no sunshine can fall on the front of the lens. If we set up the camera in front of the house, so that the sun is well to one side or the other, we cannot fail to notice that the presence of well-defined shadows helps greatly to give the view solidity or relief.

Having decided the aspect, we have to decide next the distance of the camera from the subject. The farther away we go, the smaller will be the image on the plate. One is tempted at first to go far enough to include the whole house, roof, chimney-pots, and some of the sky above it ; and very often it is evident from the result that pains have been taken to do this, and the subject has only just been crowded on to the plate. The picture fits it like a glove. Such a result shows at a glance that it is the work of a beginner. The subject should always be well inside the boundaries of the picture. It may be that we cannot go far enough from the house to get it well on and still secure an uninterrupted view. For this and other reasons it will be best to be satisfied with a picture which only shows a part of it, excluding the roof entirely, or, at any rate, most of it. If we take care that no sky at all comes into the picture, success will be all the easier. For other reasons we shall do well to avoid the straight front view, selecting a position from which we see two sides of the house—one in light and one in shadow.

There is always a temptation to work with the camera close up to the subject, so as to get it on a fairly large scale ; but by keeping well away from it, a more natural appearance is obtained. For example, in the case of a house with a sloping roof, if we are very near to it, we do not see the roof at all ; if we go farther away, the roof is seen, but is violently foreshortened ; whereas if we go still farther, the roof occupies a larger proportion of the picture, and the whole effect is much more nearly like what we are accustomed to see.

In arranging the subject, the ground-glass focussing screen is a great help. We can then see the picture of its full size—we shall also be able to focus it properly. A little finder is a handicap, both because it shows the picture on so small a scale that one can very easily overlook and omit important parts of the subject, or include objects which we should prefer to be without, and because such finders cannot be absolutely accurate in all cases, and very often are far from being as accurate as they can be. If we are arranging the picture with nothing better to guide us than a small finder, we must take care to see that everything which we wish to get in the picture comes well within the margins of the finder, in order to allow for finder inaccuracies.

On the ground-glass focussing screen, except in the case of a reflex camera, the subject is seen upside down. Arranging the picture may seem a little awkward at first on this account; but one soon gets used to it, and comes to regard it as a matter of course. Particular attention should be given to the corners of the picture, as they generally seem darker, and are not so readily seen on the screen; one is likely, therefore, to overlook them.

I have assumed that the camera is on some kind of support, as this makes the manipulation much easier. If a tripod is not available, a little table or pair of steps can be made to serve. Three sticks of about five feet long, tied together eight or nine inches from the end, and then opened out, make quite a serviceable stand. It need not be very firm, provided we take care not to shake it just at the moment of making the exposure, and provided there is no wind blowing.

Most modern cameras are fitted with a spirit level, and its presence is apt to give needless importance to having the camera quite level. With such a subject as a house, we must be careful not to tilt the camera, as, if we do, we shall find that the photograph shows it with its walls apparently falling inwards at the top. But in portraits, landscapes, and other subjects in which there are no straight vertical lines, tilting is generally quite unimportant, and one can point the camera in any direction that gives the effect desired.

The answer to the question what exposure should be given will be found in the next chapter. But for a moment we will anticipate it, and deal with the actual making of the exposure, or "pressing the button." Many photographs, when closely examined, are seen to be slightly blurred all over, while in some cases the blurring may be anything but slight. This defect, which utterly unfits them for enlarging, and is often objectionable even in a contact print, is due to the camera having been shaken during the exposure.

It is usually quite an easy matter to distinguish between this fault and the blurring which is due to bad focussing. In the latter case, the blurring is nearly always uneven ; one part may be quite sharp and another blurred, unless, indeed, the focussing has been so violently wrong as to make everything almost unrecognizable. When the fault is a shaken camera, the shake generally affects the whole image equally ; sometimes giving it a general blur, and sometimes a blur with a distinct suggestion of direction, by which we can judge if the shake has been up and down, or from side to side.

One reason why this defect is so often seen is that a great many workers have never had impressed upon them the necessity for holding the camera perfectly still when taking a snapshot. There seems to be an impression that whenever a shutter is used, that instrument will counteract the effect of any shake. This view is wrong. From the time the shutter starts to uncover the lens until it completely covers it again, the camera must be so steady that the image formed by the lens on the plate or film does not shift appreciably. In the case of a time exposure there is just the same necessity. The camera does not have to be any steadier ; the only difference is that it has to be steady for a longer time. For this reason, it is out of the question to hold the camera in the hand for a time exposure.

Not only must the camera be put on a stand of some kind if we are to give a time exposure, but we must also take care not to communicate any shake to it. Thus, we cannot give a time exposure by means of the shutter and the ordinary trigger or button release. The shutter may have graduations marked " B " and " T." The " B " stands, rather inconsequentially, for " bulb ", and when the shutter is set to this and the button is pressed or the bulb squeezed, the shutter opens and remains open as long as the pressure lasts. When set to " T," which stands for " time," the first pressure causes the shutter to uncover the lens and a second pressure makes it close. Mere pressure of the trigger to open the shutter will shake the camera enough to blur the image. Therefore, if a shutter is to be used to give a time exposure, we must adopt some device to guard the camera against such a shake. If a rubber ball and tube are provided, we have an excellent method of working the shutter for time exposures. Another method is that of the "Antinous" release, in which a wire is used, on the principle of the Bowden brake.

If the photographer has neither pneumatic nor Antinous release, he can give his time exposures with the cap of the lens, if it has one, putting the cap on the lens, then setting the shutter open, removing and replacing the cap, and finally closing the shutter. If the lens has no cap, and no hood on which one can be put, the following simple method can be used. Some black opaque object is held just in front of the lens and close to it, while the shutter is set open. It may be the shutter of the dark-slide, or a piece of black card, or the focussing cloth bunched up. Opening the shutter is sure to impart a slight tremor to the camera; so we wait a second or two for this to subside, and then make the exposure by removing whatever it is that is being held in front of the lens, and then replacing it.

A similar method is best when exposing with the lens cap. This is often so tight a fit that when it is taken off the lens it causes a slight shake. Therefore, on taking it off, the exposure is not made at once, but it is held a moment close in front of the lens but not touching it, for this shake to subside. If that side of the lens cap, or whatever object is held in front of the lens, which is turned towards the lens, is black, there need be no fear of light leaking in during this pause, in sufficient quantity to do any harm.

When a time exposure is being given, it is often possible to use a very shaky support quite successfully, if we take care, in the way just mentioned, not to transmit any shake just before exposure. One thing must on no account be done: we must never place the hand on the camera to steady it. That is almost certain to impart a shake to it.

Movement is just as serious a matter when it happens in hand camera work, except that, as exposures are shorter, it is more easily prevented. In spite of this, next to under-exposure, it is the commonest fault. It is nearly always due to pressing the button in the wrong way. I have seen this done so that the whole camera was visibly swung round, with, of course, disastrous results on the definition of the picture; and I have known photographers lay great stress on the possession of a particularly fine lens, who, nevertheless, never used it is such a way as to get any of the high quality for which they had paid. Yet the principle of exposing without a jerk is quite a simple one. It is that the camera must be held in such a way that any pressure on the instrument by the finger which is on the button is counteracted by a pressure in the opposite direction with the other fingers.

A simple example of what is meant is found in the squeezing of a lemon. Pushing one side of it with the thumb merely moves the lemon, but pushing with the thumb, and at the same time counteracting that push with the fingers, causes the lemon to remain where it is, but to give out its juice.

Just how this principle is applied in the case of any particular hand camera will depend upon the construction of the camera, the position of the shutter release, and the finger which is to be used to liberate it; but it will always be applicable, one way or another, and the necessity for it should not be lost sight of until the exposing is unconsciously done in the right way. In all ordinary hand camera work, where exposures are long enough to give a properly exposed negative, it is most important. If the camera has been held quite still, those parts of the subject which were properly focussed will have their outlines as clearly defined as the edge of the picture itself, where it comes against the rebate of the slide or sheath. If they are not, there is no doubt the camera was not held as motionless as it ought to have been.

All these precautions in exposure apply, not only in the case of the house, which we have supposed the beginner to select for his first experiment, but to any and every exposure he makes.

CHAPTER XIII

The Exposure Problem

LATITUDE IN EXPOSURE—THE IMPORTANCE OF CORRECT EXPOSURE—EXPOSURES WITH A HAND CAMERA—THE USE OF AN EXPOSURE METER—EXPOSE FOR THE SHADOWS—A TYPICAL CASE.

OF course, no merely human photographer will have bought a camera and a copy of this book, and will have read steadily up to this point without making an exposure. He will no doubt have made many, and in all probability will have got some very successful results. For it is a curious fact, although one which admits of easy explanation, that in the earliest stages of all, the less the photographer knows about it the more successful does he seem to be. He starts off usually by getting some photographs with which he is very pleased, and it is only when he reaches the second stage that failures seem inevitable. Let him not be discouraged ; it is a phase through which he must pass, if he wishes to go from that at which success is a mere matter of chance to one at which it becomes a matter of course.

The explanation of the beginner's good fortune is that at first, knowing practically nothing at all about exposure, it is purely a matter of luck, and luck may do what his judgment is not yet fitted to do. Then he tackles the exposure problem in earnest, tries to repeat his former successes, and fails, because chance no longer has free play, while the necessary skill has still to be acquired.

It is in the attempt to repeat exposures that one is most likely to go astray at first. What are called " technical data " are by no means so valuable as might be supposed. When we read underneath a picture that it had " one-tenth of a second at f/8 on an extra rapid plate at 3.30 on a July afternoon " it seems so helpful. All one has to do is to give the same exposure when the circumstances are pretty much the same. "All!" In actual work we can seldom be sure the circumstances are pretty much the same; in fact, one is generally on safe ground in assuming that, however close they may seem to be, they are not the same. There are several reasons for this, which will appear in course of time. At present, the reader will be well advised to regard each separate subject which he attempts to photograph as being quite distinct from any other that he has dealt with himself, or read about. He need not ignore experience as he progresses—in fact, it would be silly to do so; but at first, at any rate, he will get on quicker by working out the exposure each time from the basis of the facts of that particular case.

In exposing we are helped very much by what is called "latitude of exposure." Thanks to this, there is, in most cases, no such thing as *the* correct exposure, but there are limits within which any exposure will be correct. And, fortunately for us, in the conditions under which most amateur photographers' work is done, these are very wide limits. Few realize how wide they really are. Two plates may be exposed on a landscape in absolutely identical circumstances in every respect; one may have at least eight times as long as the other, and yet both may be correctly exposed. By "correctly exposed," I do not mean that one may have had the correct exposure, and the other an exposure which was just near enough; but that both have been correct in the full sense of the term. What is more, good prints made from such two negatives should not be distinguishable; or, if there is any difference at all between them, it should need an expert's eye to detect it. Nor is this eight times a maximum; it is quite likely that sixteen times would be nearer the mark.

In impressing this matter of latitude upon photographers, I have sometimes received letters in which the writers evidently regarded it as advocating or justifying slipshod work, and think that I have been encouraging beginners to be satisfied with something that is "near enough," but not the best. There is no reason why anyone should not try to get his exposures as correct as ever he can make them; but he is not helped by believing that he has to work within narrower limits than are actually the case. These limits vary with different branches of work, and with different kinds of material; but with all the subjects which the beginner is likely to undertake at first they are very wide ones, as we have seen. Exposures made with an instantaneous shutter are almost always, of necessity, on the short side; so that the expert hand camera worker generally gives as long an exposure as he conveniently can, provided his subject will not show any movement.

Some of the more old-fashioned text books had much to say on the power which it was supposed that the photographer possessed of remedying any error in exposure by alterations in development; but a deeper study of the subject of gradation has shown that this power has no real existence, and that, for all practical purposes, the character of the final picture has been settled, once for all, when the exposure has been made. By dodging in the developer we could get an incorrect exposure to yield a negative looking something like one that has had a correct exposure, but we have not altered the nature of the print which it will yield; and as almost all negatives are made for the sole purpose of providing prints, there is nothing gained by such dodging. Moreover, the belief that it could be done tended naturally to make the believer attach less importance than he should do to correct exposure.

Under-exposure is the most serious fault from the point of view of the result, since a print from an under-exposed negative can never look anything but wrong. Under-exposure, it may be pointed out, is the prevailing fault in beginners' exposures, and one which often figures also in the work of those who are not beginners.

If I were to pick up at random a handful of prints produced by beginners, it would be perfectly safe to wager that, at the lowest, three-fourths of them would be examples of this defect, while, if I wished to find an example of over-exposure, I might have to hunt through hundreds of such prints. Some of this is due to the hand camera, of course, and to the failure to realize how many subjects there are that cannot be taken with a hand camera of the ordinary type without under-exposure, but a good deal cannot be explained in this way. Some under-exposures are caused by the shutter exposure being unnecessarily short; and some by the failure to realize how much " latitude " there is. If ever the photographer is hesitating as to whether to give, say, a twenty-fifth or a hundredth of a second, it is almost certain that if he chooses the longer exposure he will be more likely to be right than if he chooses the shorter.

Another point in connection with this subject on which there is often some misconception is with regard to differences of exposure. When two or three photographers are working together, one sometimes will hear a discussion, or at least mention of a difference of opinion, as to whether an exposure should be, say, two or three seconds. So small a difference as this can only be of importance if both exposures are wrong. True, if an exposure of three seconds, in the particular circumstances of the case, is too little, one of two seconds will be still worse, and may even be perceptibly worse, though this is not very likely. But if three seconds is sufficient to give a correctly exposed negative, then we may be certain that if we give two seconds we shall not be able to find any indication that we have not given enough.

As a broad rule, as far as the exposure of negatives is in question, we may take it that the smallest difference that will give us an appreciable result in the print will be that of 1 : 2. That is to say, if we think some exposure is not correct, and determine to alter it, if it is thought to be not enough, then it should be doubled at least ; if it is thought to be too much, it should at least be halved. Four to one is a still better minimum change. Anything less extensive than this will have too trifling an effect to be worth making.

It will be noticed that these are proportional figures. Any change we may make should be in proportion to the figure that is to be changed. An extra second will make no difference worth mention when added to an exposure of three or four seconds ; but it will, of course, make a perceptible difference in the case of an exposure of a quarter of a second.

The user of a hand camera may think that the exposure problem does not affect him very much, as he just gives a " snap " without knowing what actual time it stands for, and, with many patterns of camera, without being able to change the length of the exposure at will. Of course, he can ignore exposure calculation, but this will simply mean that he will only get a properly exposed negative now and again, and that all the rest will be failures. The advantage of knowing the limits within which a correct exposure would lie is that when we cannot give that exposure we need not make an exposure at all, and so save what would otherwise be a wasted plate or wasted film.

Hand cameras, the shutters of which are not adjustable, may be assumed to give exposures between one-twentieth and one-thirtieth of a second. Many adjustable shutters are graduated to give one-fifth, one-twenty-fifth, one-fiftieth, and one-hundredth second, and this range is a very good one for all-round work, provided we have a lens working at not less than f/8, although the fiftieth and the hundredth are seldom required. For very rapidly moving objects, taken on a large scale, a shorter exposure than the hundredth of a second is needed. Such exposures come into the category of expert high-speed work, which requires not merely special apparatus, but a high degree of skill. The really useful speed is one-twenty-fifth, which is just about the longest which the beginner can give with reasonable confidence that he is holding the camera still enough ; an expert would prefer one-tenth second, perhaps.

The advantages of putting the camera on a stand and giving time exposures are that, provided the subject will remain still, we can give just as long as may be necessary to yield a properly exposed negative, and slow time exposures can be given much more accurately than those that are to be made with the average shutter, an instrument which is often far from being as correct as it purports to be.

We will now see how correct exposure can be ensured. The exposure which we have to give in any particular case depends on certain factors which we can settle definitely beforehand, and on others which can only be determined at the time. In the former class we have the aperture of the lens, and the sensitiveness of the emulsion on the plate or film ; and in the latter we have the strength of the light and the extent to which it can reach the subject.

When these various factors had to be estimated and balanced up one against the other by the photographer without any mechanical help, the exposure problem was a problem indeed. Now, by means of a little device known as an "exposure meter" it is very much simplified, and anyone caring to take the trouble can learn very quickly all that need be known in order to expose correctly.

There are two classes of exposure appliances—exposure tables or calculating machines, and exposure meters. An exposure meter has incorporated in it a piece of sensitive paper by which the strength of the light at the time of exposure can actually be measured, whereas in exposure tables this is only estimated. Both appliances have scales or dials by means of which the exposure is calculated. A form of exposure meter which is growing in popularity is of what is called the "extinction" type. It does not measure the photographic value of the light, but its strength to the eye, a scale on it showing the brightness of the illumination when a test object can just be seen. Then there are exposure tables, which are certainly very much better for the purpose than nothing; but a meter which tests the photographic power of the light is far more useful, and that is what I recommend.

In my own work I use the Watkins "Bee" meter. With meters as with plates, it is very important to keep to one until not only is the user thoroughly familiar with it, but has learnt the right way to use it, and has acquired confidence in it by finding that it gives him good negatives. As with most other operations in photography, there is a little knack required, which practice alone can give, if one is to get a correct result every time; but this knack is soon obtained, and the meter is actively helpful from the very first.

Each maker sends out working instructions with his meter, and so there will be no need here to give a paraphrase of such directions; but, by way of amplifying them and perhaps helping to make them clearer for the beginner, I will describe exactly how the "Bee" meter would be used in some imaginary case. To do so, I will assume that the reader wishes to take a photograph of some simple everyday subject, such as was considered in the previous chapter, the front of a house.

With the meter he will have obtained a "speed list," giving all the standard makes of plates and films, and allotting to each a speed number which is to be used with the meter. If the "speed list" is wanting, there may be speed numbers given on the packet of sensitive materials, but the list sent out by the makers of the meter is what should be used. There is no need, of course, to carry the list; all that has to be done is to learn from it the speed number of the particular plates or films selected, and, as the photographer will be keeping to the same brand and make, he will keep to that number also. Different lots of the same material do not vary so much that any allowance for their variation need be made. There is a general tendency for plates and films to be made more and more sensitive; but it is a slow progress, and a speed list a year or two old will generally be found for all practical purposes to be as good as one which is up to date.

Looking out the speed on such a list, then, we may find that the plates we are going to use are marked "130 S." We can ignore the "S," as that does not refer to speed, but to another characteristic, and make a mental note that our plates have a "Watkins" speed of 130.

If the lens has an iris diaphragm, we may find that it is graduated with a series of numbers preceded by the letter f. Thus we may find it marked f/8, f/11, f/16, and so on, and these, as already explained, indicate the aperture or rapidity of the lens. For our present purpose we may take it that all we need to know about the lens in connection with exposure is its "f/- number."

Some of the simpler types of lenses do not have iris diaphragms—in fact, some have merely one fixed stop. Some are graduated upon some other system, and some are marked with arbitrary numbers, while others are not marked at all. In any case, before we can hope to expose correctly we must know what are the "f/- numbers" of the stops. If it is not marked, a line to the maker will generally bring the required information; if not, there is nothing for it but to measure it for oneself, as previously described. It must be known in one way or another before we can work out the exposure.

To photograph such a subject as the front of a house, for which, it is to be presumed, we can choose our own time, we shall select a period when the sun is shining diagonally upon it, unless it happens to face north, when this will be inconvenient. We have chosen a standpoint from which we can see part of the house in the sunlight and part in shadow, and having decided this, and settled, if the stops are variable, which particular stop we shall use, we have only to find out the strength of the light by means of the sensitive paper in the meter.

There is an axiom in photography which every photographer should commit to memory. It is to " expose for the shadows and develop for the high lights." The meaning of this, as far as it bears on exposure, is that the exposure must be long enough to give good gradation in the darker parts of the picture—the shadows ; if it is not, we may be quite sure that the photograph will be a failure. Accordingly, we must use the meter to measure the strength of the light that falls on the shadows of the subject, using the word " shadows " here in the sense of the main shadows—those which are large enough to contain any detail we wish to show.

In many subjects, and in all probability in the case of the house we are now considering, there will be shadows which are very deep, and in which detail is not required. For example, the doorway may be in shadow, and we shall require gradation there (if its image is of any size) to suggest the door itself, But a very small door or window or other opening into a dark space beyond will be sufficiently rendered without detail, so that we can ignore it in calculating the exposure. But the doorway in shadow, in which we wish detail, if it is the darkest of such shadows in our subject, may be taken as the basis for ascertaining the exposure.

Accordingly we carry the meter to that doorway, and, holding it in the shadow with the sensitive paper in it turned towards the main expanse of sky from which the light is coming, we proceed to measure the strength of the light in the particular way described in the meter instructions.

The meter has what is called a " standard tint "—a patch of paper toned to a dull drab colour—to match which the sensitive paper will gradually darken, and we measure the light by taking the time that the paper requires to darken to that tint. It will probably be slow enough to time with a watch with a second hand ; if we count the seconds we must remember that a second is an appreciable time, say about as long as it takes to say " one, two, three, four " quite distinctly.

Some seem to find it difficult to tell when the depth of tint of the sensitive paper matches the standard tint, but it is hard to understand what is the real nature of their difficulty. The colour may not always match, as there seem to be variations in the shade taken by the paper; but it should be quite simple to recognize when one tint is as deep as the other—that is to say, when neither looks lighter nor darker. If the meter is so turned that the edge of the paper which forms the standard tint does not cast any shadow on the sensitive paper, this may assist; and it is helpful to some to hold the meter at arm's length and partially close the eyes, the time being taken by noting when, in that way, no dividing line can be seen between the sensitive paper and the paper bearing the tint. If one really finds any trouble in deciding when the tints match, it will not be a waste of good material to make two or three tests at first, or to get a friend to make a test or two also, and to see how they agree; or, if they differ a little, to average out the results. There is, at any rate, no difficulty that can be regarded as serious: it only amounts to that of grasping what the instructions mean.

With some subjects it may not be possible to carry the meter to the principal shadow and to measure the strength of the light there; but in such a case it is almost always a simple matter to find a similar shadow near at hand, and to measure the light in that, always remembering to turn the meter so as to face that quarter from which the chief illumination reaches the shadow in the subject itself. With the majority of outdoor work we can do all that is necessary by holding the meter in the shadow of the body. At first—and, indeed, invariably with such a subject as we are supposing—it is best to take the meter to it and measure the light on the spot.

Having thus ascertained the strength of the light, and knowing the "f/- number" of the stop in the lens, and the speed of the plate or film, the meter will tell us at once what exposure to give. The arrangement of the scales varies with different patterns, but the makers' instructions are generally clear enough. In the "Bee" meter, assuming that the plate speed is 130, the "f/- number" is f/11, and the time taken for the meter paper to darken to the standard tint is sixteen seconds, we turn the glass and back of the meter so as to bring f/11 against 130, and then turn to the figure 16 in the scale marked " Light." Against this 16 on the rim of the meter we find '4 in the scale marked " Exp.," and we know from that that the meter indicates a quarter of a second as the exposure, the ' against the 4, as the instructions explain, indicating that it stands for ¼ and not for 4.

It might be supposed from this that the meter having indicated a quarter of a second as the exposure, all we need do is to give that time. But it was pointed out just now that there is no one time which is the correct exposure, but rather a period within which any exposure will be correct. Now if the meter has been properly used, the exposure which it indicates is the shortest correct exposure, and we can always give twice or even four times what it indicates without any fear of over-exposure. In fact, unless the movement of the subject itself compels us to give as brief an exposure as possible, it is always advisable to give twice what the meter indicates, so as to make sure that the exposure actually given lies well within the period of correct exposure. Accordingly, as there is no fear of the house moving, we shall do well, in such a case as we have imagined, to give half a second.

An exposure of half a second is not easily timed. It is too long to give automatically with a shutter, unless it is a very good one, and is very short to give by hand. One second is easier to deal with, so that if the lens we are using has adjustable stops, we can put in a smaller stop, and find out what exposure that will require. As we found that the meter indicated a quarter of a second with f/11, we shall find that it reads half a second for f/16, and so can stop down to f/16 and give twice that, namely, one second. On the other hand, we may use a larger stop than f/11, say f/6, in which case the meter reading would be about one-sixteenth of a second. Twice this is one-eighth of a second, for which or for one-tenth of a second it is possible that our shutter may be graduated, and we can give a shutter exposure in that way.

But the beginner who has only a very simple type of hand camera may find that he has no shutter control at all. He cannot alter its speed; all he can do is to give a simple " snap." Shutters of this kind generally work at somewhere between one-twentieth and one-thirtieth of a second. If, then, the exposure meter indicates that an exposure of one-twentieth of a second is sufficient, we know we can use the camera with a reasonable hope of success. If it indicates anything shorter than a twentieth of a second, also, we shall be able to take it. but if the meter reading is appreciably longer than a twentieth of a second, say an eighth or a fifth of a second, then it is quite useless to give a shutter exposure. The result can only be failure. So that if the meter has not enabled us to get a correctly exposed negative, it has at least saved the cost of a plate or film. It may be taken definitely for granted that it is useless to make an exposure if the circumstances are such that we cannot give at least as long, or almost as long, an exposure as the meter indicates. If it indicates one-eighth of a second and the shutter is graduated for one-tenth of a second, we could give that without much fear of failure ; but if the meter indicates one-eighth and we can only give one-twenty-fifth, we cannot hope to succeed.

Whatever may be the subject with which we have to deal, the meter will tell us the shortest exposure with which we can hope to get a good negative. When we remember than at exposure meter can be bought for a very few shillings, and that it has saved its entire cost when it has prevented us from making a dozen wrong exposures, to say nothing of the disappointment and wasted labour avoided, it will be understood why it was that I advocated getting such an appliance and using it from the very start.

CHAPTER XIV

Developing the Negative

CHOICE OF A DEVELOPER—DEVELOPMENT BY TIME—THE APPEARANCE OF THE IMAGE—SIGNS OF CORRECT EXPOSURE OR OTHERWISE—FIXING—WASHING—WHAT A GOOD NEGATIVE SHOULD LOOK LIKE.

IF a plate or film is carefully examined in the dark room light before and after exposure, no difference in its appearance will be perceptible. The layer of sensitive emulsion has the same unbroken creamy appearance when it comes from the camera as it has when it was first taken out of its packet ; the image is there, but it is latent, and it requires the developing process to bring it out and make it visible.

If a plate has been exposed for very much too long a time, say hundreds, or perhaps thousands of times as long as it should have received, the image will become visible without development. If we leave a plate lying about in daylight, with part only of it covered over, we shall find that the uncovered part has darkened in the light, and also that the darkened part has acquired a curious smell. The smell is due to bromine, which the action of the light is liberating from the silver bromide. This visible darkening is far too slow to be of service in negative making, although it is what is utilized when a print is made on p.o.p. In negative work we use the light to give just the initial jerk, as it were, to separate the bromine from the silver, the actual separation being brought about by the developing solution. In a properly exposed plate the developer effects this separation in proportion to the intensity of the light action, and the process of development is to apply such a solution as will bring about such a proportional separation, without affecting the film to any appreciable extent where no light has acted at all.

It is in development that we first learn whether the exposure has been correct, and so whether we can hope to get a successful photograph; and it is doubtless due, at least in part, to this, that the belief grew up that development called for a great deal of skill and judgment. It is now known that in a great measure this was a mistake. The latent image is the vital matter; if that is right, development is almost as mechanical as fixing, or should be, and the process can be carried out as well without looking at the image as it can by watching it and allowing judgment to have play. Hence the modern practice of "time development," which is what I would urge every reader of these lines to adopt.

In time development the exposed plate (or film, understood) is placed in a developer of definite composition for a certain time, which time varies according to the make of plate and the temperature of the liquid. It is then taken out and fixed. One great advantage the method possesses is that the plate is only momentarily exposed to the red light, if at all. The development can be carried out in a covered vessel, and so we can have plenty of light in the room and do the work in comfort, without any fear of fogging the plate.

As developing is a very interesting process to watch, however, I propose to describe what can be seen to take place, especially as it will help the beginner to decide whether his exposures have been correct or not. He must not look at the negative the whole time it is developing, as that would cause it to become "fogged"; the dish must be kept covered with a card or something similar, merely taking that away for a momentary glance now and then, in order to note what is going on. The point at which to stop the operation must be determined by time, and that alone; if the beginner stops when he thinks from the look of things that it is done, he is likely to get wrong.

The requirements for the development of a plate are, in addition to the dark room lamp, a developing dish and card to cover it, a graduated measure, a chemical thermometer, some developer for which a table of times is provided, a dish of hypo solution, a jug of water and a bucket for waste liquids. The chemical thermometer is merely an ordinary thermometer with its scale either engraved on the glass, or printed on paper and enclosed in a glass tube, so that it is not affected by the solution into which the thermometer is put.

I do not propose to say much on the choice of a developer, as it is very easy to exaggerate its importance. There are dozens of formulæ for developers, any one of which is just as good as any other. The maker of the plates or films gives particulars of one or more developers in the instructions, and any of these we may be sure will be very suitable. But for the beginner they are open to the objection that they are generally unprovided with a timetable, and so he would have to work one out for himself, which is not a thing he is in a position to undertake. On the other hand, there are certain commercial preparations for which the makers supply such tables, and it is one of these which I recommend.

If the developer is a single-solution one, it will only need dilution ; if it is Rytol, which is a tabloid preparation, the tabloids must be dissolved as directed. It is very important in the timing method to be accurate in the proportion of water, as any variation in strength would cause a variation in the time which the solution took to act ; so the measuring must be done carefully. Any water that is good enough to drink is good enough for photography ; but it is better not to use water freshly drawn, as its temperature may be different from that of the room, and, by changing in temperature during development, may put the timing wrong. If it has been drawn and standing in the room for half an hour or so before use, it will be suitable.

Having prepared the developer, it is left in the graduated measure for a minute or two, with the thermometer in it, and, having read the temperature, we refer to the table to find out the time to give. It is not possible to give one time suitable for all plates and films, as different brands vary in the speed at which they develop ; so we find in the table the make of plate we are using, and the time to be given at the temperature which the thermometer indicates.

The quantity of developer to make up will depend on the size of the dish and number of plates to be developed. At first, it is well to use plenty, so that there may be no chance of not covering the surface of the film at once. This is important, as any parts that are not immediately covered will bear marks which no after treatment can remove. At the same time, we must not make up more than we immediately require, as the diluted developer does not keep. It begins to spoil from the very moment of preparation, and although it might possess the power of developing an image some days after it was mixed up, the table of times would no longer be applicable to it, and there would also be a risk of the negatives being stained. The developer in the case of negatives should on no account be used more than once.

For work in a quarter-plate dish two fluid ounces of solution will be ample. For postcards and half-plate sizes three ounces, and for the whole-plate five ounces, are the quantities to be recommended at first. Later on, as the worker gets more expert, he will find he can do with a little less.

If roll-film is to be developed in a tank or machine, the instructions already given will require a little modification to fit the altered circumstances, but, broadly speaking, the operations are the same. Developers for tanks or film machines are available ; and they are accompanied by tables showing the strength of the solution to be used, and the time of development according to the temperature.

To return to the development of a plate in a dish, when all is ready to begin, everything being in its proper place, the dark room lamp is lighted and if it is an oil lamp, it must be seen to be properly burning, as it will not be possible to open it to put anything right afterwards. The room can then be darkened and the actual development put in hand.

The glass or film negative is not a finished photograph of which any one without technical knowledge can see at a glance whether it is just what is required or not, but represents an intermediate stage in the photographic operations, and one which it requires some familiarity with photography to judge. But if what is known to be a good negative, preferably of some subject of the same class as that with which the beginner is occupied, is obtained, even if only borrowed for the time being, it will be found very useful as showing the kind of result at which to aim. Many a novice experiences difficulty from not knowing a good negative when he has got one. The type which gives the best print is not the prettiest. The clear, bright, sparkling picture in a negative gives a dull, heavy print, since clearness and sparkle are signs of under-exposure.

The exact appearance of a good negative cannot well be described, it must be seen. Attempts have been made to reproduce negatives by means of half-tone illustrations to act as guides for this purpose, but those that I have seen, and I have seen many, failed to give any useful indication. When the half-tone has been printed on transparent paper it will be found lacking in gradation when held up to the light; and any attempts to make prints from such reproductions show at once that if the original negative were a good one it had not been successfully reproduced in printers' ink. So that, if possible, a real negative should be obtained, and its appearance carefully noted both by putting it, film side downwards, on a sheet of white paper, and also by looking through it at the light.

It is well not to leave the diluted developer standing for any length of time before use, as a scum may form on its surface, and if any of this scum gets on to the plate it will stick there long enough to leave a mark which nothing we can subsequently do will remove.

The room being darkened, and a card or other cover for the dish being at hand, we may take out the plate and place it, with its coated side upwards, in the dish. The card should be put over the dish at once, while the camera or dark slide, etc., is put away. Then, the card being removed, the developer is poured over the plate in a smooth even wave, a glance is given to the surface to make quite sure that it is wetted all over, and then the card put back at once, and the time noted.

It might be thought that the action of pouring the developer over the plate is so simple that anyone could do it without any need of instruction; but there is a wrong way as well as a right way, and it is best to get into the habit of doing it correctly from the very first. The surface of the sensitive film must not be touched at any time with anything solid, so that if the developer does not go all over it at once we cannot brush it over. We must therefore use enough solution to make quite sure of covering every part; but, at the same time, we do not wish to use so much as to be wasteful.

In consequence, we adopt a certain method of pouring to make sure in the dim light that the whole plate is evenly and quickly covered.

To do this we do not need a vessel with a lip, so that if it is a graduated measure which holds the developer we turn it so that the spout is away from the dish. Holding the dish in the left hand and the measure of developer in the right, we tilt the dish a little so that the left-hand corner next the body, the corner by which we are holding it, is slightly the lowest. We put the edge of the measure over the edge of the dish nearest the corner, and then simultaneously we tilt the dish in the opposite direction and slide the measure along it from left to right, while pouring out the developer. It is a good plan to perform the operation in daylight with water and an empty dish, or one containing a plain piece of glass. The measure by the time it gets to the right-hand end of the dish should be empty, and its contents should be seen to cover the bottom of the dish in an even wave, which, starting at the corner by which we are holding the dish, crosses the bottom diagonally. The pouring on should be done about three feet from the lamp, which is best placed on some support a few inches above the table, as this enables us to see that the solution goes all over. As soon as the plate is seen to be covered, the card should be replaced.

The dish must be kept covered, during the whole time of development, except just for a moment or two, when it may be uncovered to note how the process is going. A dark room in which a plate can be developed in an uncovered dish without injury is a dark room that is improperly illuminated; as it cannot be light enough to allow the work to be done in reasonable comfort.

During the process of development the dish must be rocked. This should be done very gently, and at intervals of ten or twenty seconds. The rocking may be from side to side and then from end to end. All that is necessary is to prevent the solution from remaining quite motionless; it should flow backwards and forwards over the surface in an even wave. Various rocking machines have been designed for this purpose, but none of them is so satisfactory as rocking by hand. If the rocking is omitted, or is insufficient, a defect known as mottling manifests itself. In this the more opaque parts of the negative, as, for example, the sky in a landscape, are disfigured by marks of a more transparent character, very much like those on mottled soap. They ruin any negative in which they appear.

In dealing with our first exposure, the imaginary subject was an exterior view of a house, and we will suppose that to be what we are developing. The total time of development at the temperature ascertained may be anything from two or three minutes to a quarter of an hour, according to circumstances. If it is ten minutes, we may leave the card over the dish for, say, half a minute or a minute; and then taking it off for two or three seconds only, and taking care not to have the dish too near the lamp, we may give a quick glance at the plate.

In all probability, the even creamy appearance which it possessed before pouring on the developer will still be presented over much of its area; but those parts that represent the brightest parts of the original subject may show signs of darkening. The sky, for example, may be indicated by a greyish tint terminating in a line which clearly reveals the outline of the roof of the house. Along the margins of the plate we may notice indications of an image, stopping abruptly at a straight line which marks the extreme edges by which the plate was held in position in the camera, which received no light at all. Perhaps some of the other prominent high lights of the scene may be showing, or even the whole of the picture may be clearly visible. The card should be put back at once. It is tempting, no doubt, to peer into the plate to try and make out this or that detail; but it is a temptation to be resisted. Many a negative has been spoiled because it was unnecessarily exposed to the red light, that the photographer might look into it closely.

Perhaps as this is the first plate to be developed, it may be picked up and held for a moment in front of the light, glass side towards the lamp, and looked through. It will be seen at this stage that, even if the picture is very clearly visible while the plate lies in the dish, very little can be made out on looking through it, and that little is weak in its contrast. It is put back forthwith, covered over, and the rocking continued.

When half the total time of development has elapsed, we may look at it again. The surface will have gone much darker, but still the main outlines of the picture will be visible in a moderately good light. The edges which were not exposed to the light at all should be quite white, except perhaps where the sky comes up against them, where a little darkening of the edge does no harm. If we look through the plate at this stage, we shall find that the picture is much clearer or stronger than before, owing to a general increase in the contrasts, while at the same time the negative as a whole has become decidedly more opaque. Glancing at the glass side, we may see that that also has begun to darken in parts ; but this is not much to go by at first, as different makes of plates behave differently in this respect. In some the developed image soon becomes visible at the back, while in others, even when development is complete, the glass side shows little or no discolouration.

The remainder of the time necessary to complete development makes little visible change upon the surface of the negative viewed as it lies in the dish. It gets gradually darker and darker, until at last very little is to be seen at all, except the white edges, which should continue light in tone right up to the finish.

Anyone who is unaccustomed to the process may perhaps think that this gradual darkening over is a sign that the action is going too far ; but it is not so. The image is building itself up in the thickness of the sensitive layer, and if the plate is held to the light and examined, it will be found that the contrast which was so slight at first has been steadily growing, until when the time comes to stop development the plate contains a vigorous image which will give a good bright print.

One often hears from beginners that they find it difficult to get enough density, but almost always the cause of this is that they have stopped development too soon, deterred by the darkening over of the picture viewed as it lies in the dish. By adopting time development this is prevented.

If the negative was not correctly exposed, the appearance of the plate in the developer will be different from that just described. In the case of under-exposure, it will be found that the image is slow in making its appearance, and that, although development is continued for the full time given in the tables, the image, at least in those parts that represent the darker parts of the subject, never darkens over as it should do. Even at the finish of the development we can still see much detail as the plate lies in the dish. If under-exposure is suspected, it is well to be careful not to develop too much, as over-development exaggerates the shortcomings due to this fault. This does not mean that we can correct under exposure by short development, but merely that the time of development which the table in use indicates should on no account be exceeded in that case.

In the case of over-exposure, the plate darkens over very quickly, and long before development is half done its surface will be black all over. There is nothing for it but to go on developing, taking care on no account to under-develop. The plate may seem to be quite opaque on looking through it at the light, and the glass side may show very decided blackening; but we shall do no harm, but rather good, by giving full development. It does not at all follow that because there is a rapid darkening over the negative is over-exposed, it may be simply that it has had a full correct exposure. In any case, if there are any signs of full or over-exposure, it is important to develop fully, just as in the case of under-exposure it is important not to overdo it.

When a negative has been developed, it contains an image or picture which consists of metallic silver, which the developer has extracted from the silver bromide which was exposed to light. But in any exposed emulsion there is always a great deal more silver bromide that has not been affected by light and development than there is that which has been so altered, and therefore the developed plate still contains a great deal of silver bromide. This is sensitive to light and even if it were not, it would still be necessary to get rid of it, and it is the function of the fixing bath to dissolve it away, leaving only the silver image itself.

The substance used for fixing is hypo. "Hypo" is an abbreviation of sodium hyposulphite, the name by which the compound is best known, although its correct name is sodium thiosulphate. It possesses the property of dissolving silver bromide without affecting the metallic silver, unless it is allowed to act for a very long time indeed ; but, given time enough, and other favourable conditions, it will dissolve both the unaltered bromide and the metallic silver as well.

Hypo is very soluble in water and its solutions keep perfectly ; so that we can make up a stock solution and keep it in that form, taking a little of the stock solution and diluting it with water as required as already described (p. 53).

The strength of the fixing bath which is generally recommended for negatives is one of four ounces to the pint, which can be got by mixing equal parts of the stock solution of eight ounces to the pint and of water It is best not to make up more of the dilute solution than is actually required at the time, and to pour it away after use. Old hypo baths discolour and work irregularly, and complete fixing is important if we wish our negatives to last unaltered.

After the developed negative has been rinsed for a moment to remove most of the developer on its surface, it is placed in the hypo solution. If at this stage we look at it from the glass side we shall see that this still has very much the same creamy appearance that it had before development, this creaminess being due to the silver bromide which the hypo has to dissolve away. After a minute or two in the hypo dish it will be seen that the edges are clearing, and after the lapse of a few minutes the whole of the creamy appearance will have vanished. The negative will now be much more transparent than it was before, and we shall be able to see the picture on it much more clearly than we could before starting to fix it. But it is wrong to assume that because the creamy look has gone the negative is quite fixed. To make sure, we leave it in the hypo for about as long again. There is no need to rock the dish all the time that the negative is fixing, but it makes fixing a little quicker if we give it an occasional rock.

It is best to keep the negative in the non-actinic light of the dark room until fixing is finished ; although many workers do not do this, and freely expose their negatives to white light as soon as they have been well covered by the hypo solution. The white light makes no visible difference to the negative exposed to it for a few moments ; but it does have an effect, and if it should be found necessary afterwards to have recourse to a process known as intensification, this is more satisfactorily performed if the negative has not been exposed to white light until the fixing was complete.

To ensure permanence, complete fixing is most important, and there is no ready test which we can apply to tell when fixing is complete. We can only judge by the eye, noting the rate at which the hypo bath is acting by looking at the glass side of the plate, and allowing the fixing solution to act for twice as long as it takes for the creaminess to disappear. The same lot of hypo solution may be used for several negatives in succession, so long as it is seen to be working, but it is better not to keep it over from day to day. Hypo is a cheap chemical and a negative which is worth making at all is worth the trifling cost of enough hypo to make sure that it is permanent.

While complete fixing is very important if we are to secure permanence, it is equally important to get rid of all traces of the hypo after it has done its work. This is done by washing, and the washing of a negative is a thing which must not be done in a perfunctory or imperfect manner. It is easy to wash a single negative. We can do it in the dish in which it was fixed, by giving negative and dish a rinse after fixing, and then putting up the negative to drain for a minute or two while the dish is thoroughly washed out and rinsed. The negative itself may be rinsed under the tap to remove any of the fixing bath from the glass side and edges, as well as from the surface of the film. It is then put back into the dish and covered with clean water. After the lapse of a minute or two the water is poured off, the negative and the dish are rinsed and drained, and the plate is left for a minute or two in fresh water. It is then rinsed, drained, and refilled as before. Twelve such changes, spread over half or three-quarters of an hour, will completely remove the last traces of the hypo.

I have often been asked for less troublesome ways of washing out the hypo, but I cannot give them. I am no fonder of unnecessary work than other people, but the method just described is the one which I adopt invariably. It is also the plan which involves the minimum waste of water. There are washing machines on the market, but they all take a great deal of water and one cannot be quite confident in the way they work. The essence of thorough washing is to make each change as complete as possible, carrying the very minimum of one lot of washing water into the next, and no automatic washers with which I am acquainted do this so effectively as it can be done by hand. If there is a tap with a good water supply, one negative can be washed by supporting it horizontally just below the nozzle of the tap, on something that is a little smaller than itself, and allowing a gentle stream of water to run into the centre of it and off at the edges. A quarter of an hour in such a position is sufficient ; but if a negative is being washed in this way it is important to make quite sure that the water actually is flowing over the whole surface and running off all round.

When several negatives are to be washed at once, they can be washed in dishes in the same way as a single one, and take little, if any, longer, since one may be soaking while the others are having their water changed. It may be pointed out where water is scarce that little is gained by the use of a great excess beyond that needed to cover the plate. An eighth of an inch of liquid above the surface of the gelatine is as efficient in practice as a couple of inches or more would be.

Grooved metal racks, with a tank to hold the rack, can be bought cheaply, and are convenient for washing negatives. There is no need to get a tank with a syphon attached to it, as such syphons are not really satisfactory. If the tank has a syphon, it may be put out of action by corking up the pipe, or, preferably, by drilling a hole at the top of the bend of the syphon. The rack and tank can then be used in the same way as a dish, taking out the rack and letting the negatives drain while changing the water in the tank and refilling it. A dozen complete changes are sufficient in this case also, if they are thorough ; but I generally prefer to give one or two more in the case of a tank to allow for the extra quantity of water from the previous lot which is carried into the fresh at each change, as in the case of a rack is almost inevitable. It is well also to give the rack a shake after each draining to help to get rid of the drainings.

There is one form of washing which is the least trouble and the least efficient, and that is long soaking. Nothing whatever is gained by leaving negatives lying for a long while in the same lot of water. After two or three minutes that water has done all the washing it can do. If a negative is left lying in water all night it will be almost as necessary to give it a number of complete changes as it would be if it had been lying only for a minute or two. I mention this, as I am often asked whether negatives are washed if left soaking in the bath all night. Long soaking is not only ineffective as a method of washing, it is actively injurious. In hot weather it is no uncommon thing for negatives left soaking all night to be found irremediably spotted in the morning. Gelatine when moist is prone to decompose, and when we have a film of it in a wet condition, the sooner we can get it dry the better. Nothing is gained by prolonging the washing operation over, say, one hour.

When the washing is finished, if the surface of the film is examined, it may be found to show a powdery deposit, due to lime salts in the washing water. It does no harm to leave this on, but it is rather unsightly; and so it is usual to hold the negative under a stream of water from the tap, rubbing it meanwhile with a tuft of cotton wool. It only needs a very gentle touch with the wool to get rid of the deposit, and one should be careful not to let the finger nails touch the gelatine.

The negative has now only to be drained and dried. Draining racks are obtainable, but the amateur working in a small way does not really need one. To drain, he can put the negative in the graduated measure, diagonally, letting its top corner rest against the wall. After five minutes like this, the surface water will have run off, the glass side may be wiped, the drop of water at the lowest corner mopped up, and the negative is then in a condition to dry quickly.

No heat must be used for drying, as this would cause the gelatine to melt. All that is required is a current of dry air. One way of getting this is to open a window for an inch or two, and then to rest the negative on the top sash of the lower half of the window, leaning one corner of it against the glass of the upper half, with the film side downwards. The stream of air ascending through the opening and playing on the gelatine surface will cause it to dry very quickly. It should be looked to in order to make sure that it is not standing in a pool of water that has drained from it. The presence of the water keeps the air near it moist, and so prolongs the drying. The negative when dry is ready for the next stage, that of printing.

If the beginner cannot acquire a good negative as an object lesson, and a standard of comparison, he will need some guidance in judging his own results. We will, therefore, suppose that the finished negative has been made in the way just described, and that he wishes to know how far it is a success, and what kind of print it may be expected to yield.

We may first examine it for definition or sharpness, and to this end we observe very carefully the outlines of the principal objects—those on which we focussed, or intended to focus. If those parts are perfectly sharp we shall find that they have abrupt, clearly defined edges, not blurry indefinite borders. If it is the trunk of a tree, or the roof of a house, or the collar of a portrait, for example, it should be possible to draw the point of a pencil along a perfectly distinct line, indicating where that tree, or roof, or collar ends, and the slightest movement of the pencil to one side or the other of that clearly visible line should carry it either right on or right off the object. If this is not possible, if instead of a perfectly well-marked boundary we have a softened or blurred edge, then we say that that part of the image is not " sharp."

It does not matter, for our present purpose, whether the contrast between the object and what it comes against is great or small ; that is another matter altogether. There should be, in any case, enough contrast to enable the dividing line to be seen, and that contrast should be perfectly abrupt and well defined. If this is not so it will be impossible to get a sharp print. There are methods of getting unsharp prints from sharp negatives, a result which is sometimes required ; but there is no method by which a sharp print can be made from an unsharp negative.

If the negative is not sharp we must find out what is wrong. It may be that the focussing was not properly done. If so, while the principal object on which we intended to focus is not sharp, some other object nearer to or farther from the camera may be sharp. This is an indication that the focussing was incorrect, and, by noting whether the sharpest parts of the picture are those that are nearer or more remote, we can get an idea of the nature and extent of the error.

Perhaps every part of the picture is blurry. This is generally caused by the camera having been shaken during the exposure—a common fault. If the blurring is equal all over, it is probable that the focussing was correct but the camera was shaken; if it is unequal, then the picture may not have been properly focussed and the camera may have been shaken as well.

If the principal object is sharp, indicating correct focussing, we may examine other parts of the image—objects at other distances than the principal object. If these are unsharp, or less sharp than we think they should be, the stop used was not small enough.

The negative may next be placed film downwards on a sheet of printed matter, such as this page. Certain parts of the negative, usually strips along its edges, were protected from light in the camera by the construction of the camera, or by the edges of the sheaths or dark slides holding the plate. These edges in a finished negative should be almost perfectly transparent. If they are, it is a sign that the light used in the dark room was "safe," and that the developer was correctly made up and was not applied to the negative for too long a time. But if all these edges are badly darkened over, it is an indication that there has been something wrong in one, or both, of these directions. Either the whole of the plate or film, at some time or other, has been exposed to an unsuitable light—"light fogged" is the term used—or the developer has been too powerful, or was left on much too long. In the case of subjects in which the sky or some bright object comes up against the edge of the negative, the edge in that part may be fogged, although it may be clear enough elsewhere. Provided it is clear elsewhere, the local fogging may be ignored.

It is not possible to make perfect prints from negatives that do not have clear edges; and, if this examination shows that there is room for improvement in this respect, the first thing to be done is to find out what is wrong, so as to put it right in the future. The most frequent cause of the defect is undue exposure to the light during development.

When the negative is lying on the paper we shall be able to form an approximate idea of its contrast or density. The most transparent parts, those that represent the very darkest parts of the subject, should be almost, but never quite, as clear as the edges. The rest of the picture should be very much darker, although even its most opaque portions should be clear enough to allow this print to be read easily through them. The whole picture, in negative form, should be seen ; but it should look dark and heavy.

If there is not much contrast—that is to say, if this print can be read very easily through every part of the film—it is probable that the negative will not give a very bright print, although this will depend upon the printing process adopted. Gaslight paper will give a bright print from a comparatively weak negative.

If the whole of the picture on the negative looks very dark and opaque, although the edges of the plate are quite clean, the fault may be due to one of several causes. It may be that the lens is not fitted with a deep enough hood—a common fault in cameras of compact type, in which the lens hood has been cut down to a minimum. It may be caused, also, by over-exposure, or by over-development. A dusty lens, stray light in the camera, too strong light falling on the front glass of the lens, anything in fact which tends to scatter light indiscriminately over the sensitive surface while it is exposed in the camera, may give rise to a general heaviness of this kind, and it is also unavoidably more prevalent with lenses of very elaborate construction than with the simpler and cheaper forms.

If the negative successfully stands all the tests indicated, the beginner may safely conclude that he is working on sound lines so far as focussing, exposure, and development are concerned.

CHAPTER XV

Printing on Gaslight Paper

THE NATURE OF GASLIGHT PAPER—SOLUTIONS REQUIRED—THE LIGHT FOR PRINTING—TRIAL EXPOSURES—DEVELOPMENT OF THE PRINTS—FIXING—WASHING—SQUEEGEEING.

VERY soon after an emulsion of silver bromide in gelatine was used on glass for making negatives it was found that a similar preparation applied to paper was a suitable material for making prints and enlargements. As silver bromide was its principal ingredient the paper was called gelatino-bromide paper, subsequently shortened into bromide paper, under which name it is still known and widely used. It was found that to give the cleanest and best pictures the emulsion used for paper should not be so sensitive as that generally used for negative making, but except in this respect there is little difference between the two. The development and fixing of such papers is carried out in the same way as that of a negative ; except that in the case of prints it is surface appearance which matters, and not the gradation as seen when looking through as in a negative.

Many years after bromide paper came into extensive use, a much less sensitive emulsion still was introduced—so little sensitive, in fact, that it did not call for a " dark room," properly so termed, at all. A moderate illumination of the kind generally used indoors at night was not too much if the paper was not unnecessarily exposed to it ; although a slight trace of daylight, which is much whiter and more " actinic," would be enough to spoil it. As this paper could be worked by ordinary gaslight—even being printed by it if the printing frame were brought near enough to the light—it came to be called " gaslight paper," and is now made by many manufacturers in a wide variety of grades. Such gaslight paper, except in rapidity and in one or two minor particulars, does not differ much from bromide paper. The sensitive salt may not consist of silver bromide only, it may contain silver iodide and silver chloride—the makers do not let us into the secrets of its composition—but because one is called bromide paper and the other gaslight paper, it does not follow that one is made exclusively with silver bromide and the other is not. In the United States gaslight paper is more often referred to under the name of "development paper."

In one important respect gaslight paper and bromide paper—indeed plates and films as well—are the same, namely, that the image in the finished result consists of metallic silver. It follows that any toning or other process which can be applied to the image in the one case can be applied to the image in the other. As far as chemical analysis goes the material forming the picture in negative and in print is identical. The various operations to form the print are also the same, except for certain slight modifications of detail which will be pointed out in due course. A difference which is often of great service is that in general the slower or less sensitive papers give an image with greater contrast in it than the other kind. Beginners' negatives especially are often wanting in contrast, so that gaslight paper of this kind is very suitable for making prints from them, and a good deal of the great popularity of the paper is undoubtedly due to this. But negatives made by more expert workers, unless specially kept thin for gaslight printing, have more contrast, to enable them to be used for other printing processes, and so in course of time makers found it necessary to introduce a grade of gaslight paper called the "Soft" or "Portrait" grade, to give soft prints from vigorous negatives. Such paper is more sensitive than the other kind, although it is still not so sensitive that it cannot be worked by gaslight. The development formulæ given with the two grades differ sometimes; but it is possible to use exactly the same developer for both, and this is often done. When his photography is a little more advanced the novice will find it advisable to keep a stock of both kinds, printing his strongest negatives on the "portrait" paper, and his weaker ones on the ordinary grade.

Gaslight paper of either sort is supplied in several grades —glossy, semi-glossy, platino-matt, etc. It is best to get the platino-matt grade to start with, and postcard substance rather than paper, as this will be the easiest to handle without injury. It is wise, too, to get one of the recognized makes of gaslight paper. The market is often flooded with cheap paper and cards, incapable of giving a good print, even in the most skilful hands. There are plenty of good makes which bear the name of the firm making them, and are supplied at a standard price; common sense would indicate that at first, at any rate, it would be wiser to buy one of these than something lower in price, which may be good, but which, on the other hand, may not, while the buyer does not know enough to enable him to tell whether the material is good or not. If the packet bears the name of one of the big makers the buyer has the assurance that the manufacturer in his own interests has taken every precaution to ensure the product being as good as it can be made, and for that assurance it is well worth paying a few pence extra.

For printing on gaslight paper beside the paper itself we shall need developing and fixing solutions, a dish or two, and a printing frame. Metol-hydrokinone is usually said to be more suitable for gaslight paper than any other agent, and all instructions contain at least one metol-hydrokinone formula. On the other hand, they often include an amidol formula, and perhaps mention one of the single solution developers. If the novice intends to make up his developer himself, I should advise him to use the metol-hydrokinone as given in the instructions issued with the packet.

The printing frame for postcard and smaller sizes, may be a half-plate one. It should be fitted with a clean piece of glass, which may be fastened in by gluing strips of brown paper to the edges of the glass and frame. On the glass may be placed a piece of thin card the full size of the frame, with an opening cut in the centre the exact size required to take the negative, if this is on glass. If it is a celluloid film negative the card will not be required.

It is usual, but not invariable, for the light by which the operations are carried out to be the light actually used for printing. It may be the artificial light used in any ordinary living room, incandescent gas, electric light, lamps, etc. An ample illumination for working in comfort should be provided ; but we have to remember that the light is strong enough to make a print on the paper, so that it must be used with proper caution.

There are two ways by which we can have plenty of light and at the same time protect the paper from any injurious excess. One is to work at sufficient distance from the light. The photographic activity of a light, as already mentioned, decreases in proportion to the square of the distance ; so that we can expose a sensitive substance to a light without injury for nine times as long at twelve feet as we can at four feet, while if we increase the distance from four to twenty feet—five times as great—the possible exposure is twenty-five times as long. One way of working, therefore, is to arrange the table as far from the light as we can manage, and to rely upon distance to ensure the light being without effect on the paper. The other and more usual way is to arrange to do the work in some position near the light but screened from the direct rays. A piece of card hung from the light-fitting will furnish a large area of shadow in which to do the work, or we may set up a sheet of card on edge on the table. Sometimes the lamp is immediately over the table and casts a shadow, which is all we want. Whatever arrangement may be chosen, it is important never to leave the paper lying about without protection, even in the shadow. It should only be exposed to light when it is absolutely necessary ; as, for example, when a sheet is being put into the printing frame, and we must glance at it to make sure which is the sensitive side, or when it is being put into the developer. Gaslight paper generally develops so rapidly that there is little or nothing gained by covering the dish.

One gradually learns the proper way of handling sensitive materials. The old hand instinctively avoids touching the sensitive surface at any stage. He holds his plates, films and papers entirely by their edges or back, and he never exposes either to light unless there is an actual necessity for it. The sooner one learns to do this the sooner is the old hand's dexterity attained. Negatives and prints no longer show obtrusive finger marks that may be plain enough to give Scotland Yard all necessary identification data. The mysterious foggings which appear in the work of some beginners vanish also.

Although gaslight papers are less sensitive to light than bromide papers, they seem, as a class, curiously enough, more sensitive to mechanical injury, although in this respect different makes vary. If the surface of a sheet of gaslight paper is accidentally pressed or rubbed with something hard, even if it is only a corner of one sheet that is drawn over the front of another, a mark may remain, which, invisible at the time, becomes visible as soon as the paper is developed. Such marks are known as "friction marks," and are most likely to be met with on papers with a glossy surface, which therefore call for careful handling. The packets in which the paper is sold are well designed to protect it from light and other injury until it reaches the customer, but they do not lend themselves to being unwrapped and wrapped up frequently ; and drawing a sheet out of a packet may be enough to cause friction marks. The best plan, therefore, when getting ready to do any gaslight printing, is to have at hand a cardboard box with a well-fitting lid, larger than the pieces of paper or card, and when the packet is opened, to remove all the wrappings and keep the paper loose in the box.

In printing on gaslight paper the sensitive surface of the paper is put next to the coated side of the negative, and while the two are pressed together in the printing frame, light is allowed to pass through the negative on to the paper. The action of the light does not make a visible image, but only a latent one, which must be made visible by development. Very prolonged exposure to light will impress a visible image on either gaslight or bromide paper, but no practical use is made of this fact ; prints on either material are always developed. If after the exposure of the paper there were any signs of an image upon it, it would be clear that the paper had received many times (possibly some hundreds) as long an exposure as it should have had.

If we take a very light part of the original subject, where it comes against a dark part, say a white collar against a black coat, we shall see on the negative that the image of the collar is very opaque, whereas that of the coat is much more transparent. In the printing much more light gets through the negative to the paper in the part which represents the coat than does in the part that represents the collar, so that on development, the collar comes out much lighter than the part which represents the coat. In a good photograph there will be countless gradations of tone between the white of the collar and the black of the coat, all of which should be faithfully rendered in an inverse way in the negative and transferred the right way round to the print.

As we depend on the light-stopping power of the negative to make the print, it is important to leave no dirt on the negative on either side, as it will show in all the prints appearing in them as light patches. If the negative is on glass, therefore, before making the print we must clean the back or glass side. If it is on celluloid film it should not be necessary to clean the back ; nor is this generally possible, as in " non-curling " film the back has a coating of gelatine, which any attempt to clean would injure.

The coated side of the paper is placed next to the negative, and we should be able to recognize the coated side at a glance. In the case of almost all papers coated with a film of gelatine, at any rate in the case of all papers the beginner is likely to use, there is an infallible test. If we take a piece of paper or card out of the packet and glance at it we shall see that it does not lie perfectly flat. There is always some slight curl to it, and the concave side is the coated side. If we breathe on the coated side, or otherwise expose that side to a more damp atmosphere than the other, it will become convex instead of concave, but it will soon resume its ordinary form again. If there is any further doubt one corner may be nipped between the teeth, when the coated side will stick, whereas the back will not. In the case of glossy papers, the character of the surface will indicate plainly enough which is the coated side, and even when both sides are matt, there is generally a difference which when once recognized removes all doubt. With sensitive postcards the printed matter on the back has the advantage of leaving the beginner in no doubt about the side to put next the negative.

The exposures to electric light or to incandescent gas are not very long, provided the printing frame is within a few inches of the light. The slower papers may be printed conveniently by the light of magnesium ribbon, the exposures being measured by using a definite length of the ribbon burnt at a measured distance from the frame. Whatever may be the light used, the actual length of exposure depends on the sensitiveness of the brand of paper in use, which varies with different makes ; upon the opacity and colour of the image in the negative; upon the strength and nature of the light ; and upon the distance of the printing frame from the light.

In printing there is none of that latitude of exposure which is so useful in negative making. There is one correct exposure, and anything that varies from that by more than a small proportion is wrong. On the other hand, by keeping to one make of gaslight paper, and by always using the same illuminant with the printing frame at the same distance from it, we get rid of all the variable factors except those of the negative itself ; so it soon becomes a simple matter to expose the paper correctly every time. When once the correct exposure is found for any negative, we can make a note in pencil at one corner of the film, and at any time afterwards by referring to that note we can give the correct exposure straight away, provided we are still using the same light for printing, and the same brand of gaslight paper. This is in itself a strong reason for keeping to one set of conditions, at least till the worker is reasonably proficient.

Much of the gaslight paper wasted through incorrect exposure is spoiled because sufficient importance is not attached to the distance of the printing frame from the light. The printing is usually done so near to the light that a variation of only an inch or so each way makes an enormous variation in the exposure. It is absurd to time the exposures carefully while guessing the distance. If six inches is the distance at which it is proposed to work, six inches should be measured and marked. One way is to nail a strip of wood to the printing frame so that it sticks out straight in front of the frame. The frame is then held up to the light in such a manner that the end of this piece of wood touches the light fitting in some selected place, and the length of the wood is adjusted so that the frame is then at the required distance. Or the frame may be furnished with an eyelet and hung on a hook fixed at the selected distance from the light. At five inches from the light the paper is receiving almost exactly twice as much light as it is at seven inches, so that the need for care in keeping the distance of the frame uniform should be plain.

The most economical way of starting to make gaslight prints is to devote the first piece of paper to a trial series of exposures. The printed instructions enclosed with the paper generally give some idea of the exposure required with a "normal" negative; the novice's difficulty is to decide whether his negative is a normal one or not.

Let us suppose that the instructions state that twelve seconds at six inches from a gas burner are required for normal negatives; the printing frame is put up at that distance, a card being held for the moment in front of it. Withdrawing the card quickly when it is in position, we start to count seconds, and at the lapse of six, nine, twelve, fifteen, and eighteen seconds we move the card more and more over the negative, so that at eighteen seconds it is fully covered once more. In doing this the card should be held as near to the negative as we can get it, in order to get as sharp a dividing line between the exposures as possible. Such a print should show what is the correct exposure for that negative, and with a second piece of paper we can give that exposure to the whole. Thus we shall have learned in the most satisfactory way—that is, by actual trial—what is the correct exposure for that negative; and for other negatives a very little practice in gaslight printing will serve to show what variation, if any, need be made from that exposure.

For this trial series to give us a perfectly reliable indication, one or two points must be noted. The printing frame must be held squarely to the light, as if one end is nearer than the other the indication may not be correct. Moreover, the direction in which the card is moved over the picture must be such that each strip that is exposed has much the same character of subject on it. For example, if it is a landscape with a strip of sky along the top and some heavy shadows along the bottom, it would not do to move the card from top to bottom or *vice versa*, as the exposure that happened to look right in the case of the dark foreground or of the light sky might be altogether wrong for the picture as a whole. So that in such a case it would be best to move the card from one side of the picture to the other rather than from top to bottom, so that each member of the series had some of the foreground shadows and some of the sky in it. The development of such a trial strip must be carried out in exactly the same way as that of the print for which it is to form a guide.

Although the emulsion on gaslight paper is, in the main, identical with that on plates and films, and the development of it is carried out by using much the same reagents, there are distinct differences. One of these is obvious enough ; it is, that while in a negative it does not matter whether or not the image has a colour that is pleasant to the eye, provided it will give a good print in reasonable time, in the print the colour or tone of the picture has necessarily to be considered.

Another point of difference which is not so self-evident is that, in developing a negative, we rarely, if ever, carry the development as far as it will go, since this would give us a degree of contrast with which no printing process could deal. The point at which development is stopped, therefore, becomes of importance ; and the precise position of that point is dependent upon the printing process with which the negative is to be used. We develop our negatives a little longer for some printing processes than for others ; or, if we do not do so deliberately, we find, at least, that those that have been most fully developed give the best results by one process, while those that have been less fully developed give the best by another.

In making prints on bromide or gaslight paper the results of the light action must be brought right out. In other words, the development must be continued until the visible effect appears to cease ; and if, when this happens, it is found that the print is too light, there is nothing to be done. It is an indication that the exposure has been insufficient, and a fresh print must be made. In the same way, if the exposure has been too long, the finished print will be too heavy, and a fresh print must be made giving less exposure. It is not possible to watch the development of a piece of gaslight paper that has been over-exposed, to snatch it out when it seems to be sufficiently dark, and fix it there and then. The result will be a weak picture, with no depth or richness in its shadows, and generally unsatisfactory.

The best gaslight prints are obtained by the use of a more concentrated developer than is usual either for bromide paper or negative work. There is no doubt that gaslight paper is most satisfactory when a strong and only very slightly restrained developer is used, and when development is rapid and quite complete. It is very important, therefore, to pour the developer over the whole print at once, as any delay, however slight, is likely to leave a mark ; since the part that is not covered at the first never seems to catch up the rest, even when the development of the rest appears to have stopped. Unless the delay was only momentary, a dividing line will show in the finished print.

Enough of the developing solution must be used to make sure that the print is quickly and completely covered. For quarter-plate or postcard sizes, four ounces is none too much. It is customary in the case of gaslight and bromide prints to use the same lot of developer over and over again ; so that the use of such a quantity is not as wasteful as it would be if used for a single print only.

The objection to the repeated use of the same lot of developer is that it eventually gives prints of poor colour. The result of developing is not merely to use up some of the active agent, so that the solution is weaker when applied to the second print than it was when applied to the first, but also to contaminate it with chemicals which are formed by the development process itself. One of the most important of these is bromide. If the alkali in the developer is sodium carbonate or sodium hydrate, as it usually is, one result of development is the formation of sodium bromide in the solution. This sodium bromide has the same effect as potassium bromide. Now, most of the formulæ for developers for gaslight paper include a little potassium bromide, which is added to help to keep the whites of the print pure. But it is only a very small quantity indeed ; and if this quantity is exceeded to any great extent, it will be found that, instead of getting prints of a good black and white colour, we only get rather unpleasant greenish blacks. The effect of the presence of sodium bromide due to the repeated use of solution is the same. The developer may go on developing print after print, but those last developed will have greenish instead of pure blacks, and will not be at all satisfactory. The action is a gradual one, so that it is not possible to say that the developer can be used so many times and no more. Each successive print will be slightly poorer in colour than its predecessor, although the difference may only be perceptible if we compare the print with one developed several prints previously. What we have to do, therefore, is to be careful to cease using the developer before the colour of the print suffers appreciably, and to make sure of this the fixed prints must be looked at in white light. The developer costs so much less than paper that it is poor economy to risk a print rather than to take a little fresh solution.

Where a good many prints are to be developed, it is best to use a small quantity of developer for a few prints and then to take fresh, rather than to use a big bulk for the whole lot. In writing of using the same developer more than once, it must be understood, of course, that it refers to one time of using only. After use the developer should be thrown away ; it cannot be kept from day to day.

Let us suppose, then, that the paper has been exposed, the developer mixed up, and all is ready for development. The print is placed in a clean dish, sensitive surface uppermost, and the developer poured over it, giving the vessel containing the liquid a kind of a swirl in doing so, so that the developer is not just splashed on, but flows over the paper in a wave, as described in developing a negative. The work is being done, it is assumed, in a good yellow light, such as gaslight or electric light, but in a position where the direct light from the lamp does not reach the paper in the dish. Within a very few seconds the picture will begin to appear, and will gather vigour rapidly. When it is seen to be coming up well all over, the print may be turned over and the dish rocked so that the back of the paper is also well wetted. But we must be careful not to let the face of the print remain in contact with the bottom of the dish, and, as soon as the back is well wetted, the print may be turned face upwards again.

The picture by this time should appear of its full depth, and, as development is continued, it will grow a little darker, and then the action of the developer will appear to flag. The development may be continued for a little while longer, until there is no doubt at all that the darkening is going no farther, and then the print may be picked out quickly, rinsed for a moment, and slipped into the fixing bath. Or the developer may be poured back into the measure, the dish filled up with water, and the print then taken out and fixed. Some workers omit this rinsing. It is not a necessity, but does no harm, and at least helps to get rid of the developer quickly, and to reduce the quantity of developer carried into the hypo.

Precise statements of the time taken to develop a gaslight print cannot be laid down. It varies with different papers, different developers, temperature, and the number of times the solution has been used ; but, in general, development is complete in two or three minutes, sometimes in less.

A word or two about the appearance of the print when developed may be useful. After it has been in the hypo for a few moments there is no harm in looking at it in full light, and we can then see if the exposure has been correct or not. If it looks full of vigour, not too dark, and with gradation even in the lightest part, it is evident that the exposure has been correct. But if, on the one hand, it is too dark and heavy, then we may be sure that it has been over-exposed—always assuming that the negative itself was a suitable one. If, on the other hand, the highest lights, instead of showing gradation as they should, are mere blank white, then the exposure has been insufficient. The wet print appears slightly darker and more vigorous than it will do when dry.

One of the most common defects in gaslight work is the presence of brownish-yellow markings, most visible in the lightest parts of the print. Such stains are due to under-exposure of the print and to the development having been continued too long, either from a failure to recognize that the print has been under-exposed or with the hope of bringing up the image eventually. There is no remedy for them. All we can do is to expose a fresh piece of paper for a longer time, when, if all goes well, the same developer will be found to give a perfectly clean, bright print.

As the emulsion on gaslight paper is similar in character to that on plates and films, the image is fixed in the same manner. That is to say, the print is placed in a solution of hypo until all the silver salt which the developer has not reduced to metallic silver is dissolved away. The principle of fixation is the same, but the process is carried out with some slight differences of detail.

As the colour of the image and the clearness of the whites are of great importance in printing, it is usual to employ for fixing not a plain solution of hypo, but one containing a little sulphurous acid, which is a powerful " anti-stain." Such a bath is known as an acid-fixing bath.

It is not customary to make up an acid hypo bath by the direct addition of sulphurous acid to the hypo solution, although this can be done. One way of doing so indirectly is to add a quarter of an ounce of potassium metabisulphite to the pint of hypo solution. Another plan is to prepare a stock solution by dissolving two ounces of sodium sulphite in ten ounces of water, and adding to it half an ounce of glacial acetic acid, or fifty drops of strong sulphuric acid. This solution contains free sulphurous acid, as its smell indicates plainly enough, and one ounce of it may be added to a pint of hypo solution. The exact quantity of either compound that is added to the hypo is of no very great importance, provided there is enough of the sulphurous acid present to prevent stain.

In the case of Velox paper, the makers' instructions specify a particular form of acid-fixing bath, and it is important to use this with that paper if prints of the finest colour are required. This same solution is also suitable for other gaslight papers.

In the case of negatives we can see how fast the fixing process is going on by looking at the back of the plate or film and noting how the white appearance is gradually vanishing ; but with prints we have not this guide, as, although the white deposit due to the presence of the undissolved sensitive salt of silver is there, it cannot be seen because of the paper. To secure permanent prints it is absolutely necessary for them to be properly fixed, and as we have no other means of making sure of this, we have to rely on the application of a hypo bath of a definite strength for a proper time. The manufacturers' instructions generally state the strength of the hypo and the length of time the prints are to remain in it; but they do not always lay stress on the fact that the prints during the immersion are supposed to be fully exposed to the action of the solution. That is to say, they must either be fixed for that time lying singly side by side and not on top of one another, or else the pile of prints must be kept moving.

An amateur who is making a number of prints finds himself in this difficulty. Either he must have some of his prints lying undisturbed in the fixing bath while he develops the rest; or he must try to keep them moving, at the risk of contaminating his fingers, and the prints he is developing, with hypo; or he must fix one print completely before making another. The last course is the perfect one, but it is not usually practicable. The best plan is to put each print as it is developed into the hypo bath, see that it is well covered with hypo, and then proceed to make another. When five or six have been made and put one on top of another in the fixing bath in this way, further printing should be stopped for a time. The prints in the fixing bath should then be taken in hand just as if they were not fixed at all, and should be kept in motion for the full time specified in the instructions. This can be done by drawing out the bottom print gently, putting it on the top, pressing the pile down, and then drawing out the bottom one again, and so on. When they have been fixed in this way for the full time, they should be taken out two at a time, one in each hand, allowed to drain until most of the hypo has run off them, and then put into clean water. When they are all in the water, it may be changed once or twice, and the prints left in it. The hands must then be well washed, so as to get rid of all hypo from the fingers, as a very slight trace of it would give stains, and then any further printing can be done.

This method ensures thorough fixing, and it also prevents the prints from lying too long in the hypo bath, which will happen if a great deal of printing is done before the fixing proper is put in hand. A fruitful cause of spoiled prints is this long soaking. I have known photographers who have gone on making gaslight prints for an hour or two, putting each one into the fixing bath as it was developed and leaving it there. The result is that the first prints made may be in the hypo two hours—long enough to cause all sorts of trouble from stains and irregular markings; although, even then, they may not be properly fixed all over.

As just mentioned, the slightest trace of hypo conveyed to the paper before development is finished, whether by the fingers or by a dirty dish, will leave an ugly mark in the shape of a yellowish-brown stain. It is important, therefore, to keep the hypo well away from the developer. To keep it off the hands, a good plan is to use a " paddle." Vulcanite paddles for the purpose can be bought for a few pence, but a strip of glass seven or eight inches long and a couple of inches wide does just as well. Any sharp edges may be rubbed off with a file or on the hearthstone. The print being taken out of the developer and rinsed, is merely dropped on to the top of the fixing bath, and then is pushed under the surface with the paddle. The dish should be rocked once or twice to send the hypo solution well over it, and the print left with one end of the paddle resting on it, and the other end resting on the edge of the dish.

In the case of prints the fixing bath serves a double purpose. Not only does it fix them, but it serves to wash out the developer, which if left long in the pores of gelatine or paper would stain it. Any photographic developer left exposed to the air becomes what is called " oxidized "; that is to say, it absorbs oxygen from the air and decomposes, with the formation of a brown or black substance, which, if it is formed on the print, cannot be removed, and spoils it. Hence the advantage of a rinse between development and fixing, and hence, also, the need to rock the fixing bath and keep the print well under its surface.

If the print is allowed to float on the top so that it is exposed to the air, it runs a double risk. The air may oxidize the developer in it and cause stains, and it may also cause the hypo solution to attack the exposed parts and reduce them. A print left floating on top of the fixing bath for half an hour or so will sometimes have the image in the more delicate lights eaten away.

The prints being fixed, all that remains to be done is to wash out the hypo. When dealing with the washing of negatives I pointed out that there was no royal road or short cut, and this is just as true of prints. If the prints are to be permanent they must be properly washed: and if they are worth making at all, it is surely worth while to make them permanent. I have been so often asked for an "easy" way of washing prints, and so often hear of attempts to wash prints by methods which may be very little trouble, but do not wash. Leaving them to soak for hours, even in a large quantity of water, does not wash them properly. Nor does it answer to put them in a dish in a mass, and change the water frequently. Fresh water, constantly changed, must come in contact with both sides of the print. This involves some trouble; but I know no easier way. If I did I should adopt it myself.

My own method of washing prints is to use two dishes, transferring the prints singly from one to the other. When all are in one dish the other is emptied, rinsed out, and filled with clean water. One by one the prints are then taken up, held until the water only drips from them, and then pushed well under the surface of the water in the other dish. When all are transferred, the first dish is emptied, rinsed and refilled, and so on. Twelve such changes, allowing a minute or two soaking in each lot of water, will get rid of all the hypo that can do any harm.

After washing, the prints can be dried by being pinned up where they can drain, and where dust will not settle on them. If they are pinned so as to hang from the edge of a shelf, they should be drawn along the pin towards the head, so that they touch nothing else, and there is a free play of air on both sides of them. If it is undesirable to have pinholes in them, they may be blotted surface-dry between photographic blotters (not ordinary blotting paper, which often contains hypo) or clean fluffless cloths, and then may be left lying face upwards until they are dry.

Prints on glossy paper can be given a still finer gloss by being squeegeed on to some suitable surface. Glass is the best for this purpose; but ferrotype plates, which are thin sheets of iron coated with a fine brown-black enamel, or pulp boards, or celluloid sheets can be used. Glass has the drawback that the prints tend to stick to it; to prevent this it is best to give the glass a final polish with a clean rag containing the slightest trace of paraffin oil.

We can remove all chance of the prints sticking by transferring them from the last washing water to a dish containing one part of formaldehyde solution or " formalin " to nine parts of water. This can be used over and over again until it ceases to be effective. After five minutes in this they are allowed to drain and dry without further washing, and when dry are soaked in water for a few minutes and then squeegeed. When dry they should then come off without any trouble at all ; in fact they will often drop off spontaneously as they dry.

To squeegee a print it should be picked up with plenty of water, and put face downwards on the surface by bending it into a U shape, letting the bottom of the U touch the surface first, and then lowering the rest. This drives out any air bubbles, so that the print comes into contact with the surface all over. A flat squeegee is then used, working from the centre outwards, to squeegee it into close contact and to expel the surface water. Some workers cover the print with a blotter, put a sheet of rubber or celluloid on top of that, and then squeegee either with a flat or roller squeegee. Either method answers ; all that is needed is to bring the paper and plate into close contact with no bubbles of air between them.

Heat must not be used or the gelatine surface will be softened, but they can be put where they are exposed to a good current of air. No attempt must be made to strip squeegeed prints from their support until they are absolutely dry.

Prints may be made in the same way upon the more rapid bromide papers such as are used mostly for enlarging. The dark room is necessary in such a case, however, and the exposures are much shorter, but otherwise the procedure is similar. The chapter on enlarging should be consulted for advice on the handling of rapid bromide paper.

CHAPTER XVI

Printing on Self-Toning Paper

THE NATURE OF P.O.P.—PRINTING BY DAYLIGHT—JUDGING THE DEPTH OF PRINTING—THE FIXING BATH REQUIRED—COLLODION PAPERS—THE INFLUENCE OF THE CHARACTER OF THE NEGATIVE.

WHILE gaslight paper is the most popular material on which to make prints, a great many prefer to use some daylight process. The most widely known is that which employs "p.o.p.", letters which stand for "printing-out paper." Such paper takes it name from the fact that when it is put behind the negative in the printing frame the image prints out visibly; there is no need for any subsequent development. In the strictest sense of the word, any paper which thus gives an image directly without any need of development, is a "p.o.p.", but in practice the term is limited to certain special forms of material in which the sensitive substance is, chiefly, silver chloride, carried in a film of gelatine or collodion on the surface of the paper. The papers are sometimes called "gelatino-chloride" and "collodio-chloride" in consequence. Most forms of "p.o.p." give a fine purple-brown image in the printing frame, but, as the prints have to be fixed in hypo, and in the ordinary course the hypo would convert this purple-brown into a much less attractive red or yellow, it becomes necessary to subject the image to an operation known as "toning." The operation deposits gold on the silver image, and brings back the original purple colour, or, possibly, one that is still richer.

In self-toning p.o.p. the toning material is present in the coating on the paper; so that when the prints are placed in a solution of hypo to fix, they tone at the same time. For simplicity, self-toning papers are now very largely used, and, in a book essentially for novices, this is the only kind of p.o.p. which need be dealt with at any length.

Different makes vary a good deal in the treatment they require. The strength of the fixing bath, and the depth to which the printing has to be carried to give a rich final result, vary with the make, and, as far as these factors are concerned, the reader will do well to follow the instructions of the maker of the paper he is using. For a similar reason, if he is wise, he will stick to one make until he has mastered it, and not change about. First-rate prints can be obtained on any of the standard brands; and, if his results at first are not all that he would wish, he may be sure that it is due to something wrong in his procedure, and not to the quality of the paper he is using.

Self-toning paper is much less sensitive to light than gaslight paper, and still less sensitive than the plates or films on which negatives are made. It is not visibly affected in a reasonable time by any of the ordinary forms of artificial light, so that a sheet might be left lying all the evening in a room lit by incandescent gas or electric light without being injured. Weak daylight, also, only affects it gradually. The packet may be opened and the printing frame filled in daylight indoors, provided the work is done well away from the window. One soon gets to know what it will stand without injury; but, at first, as it is inadvisable to have to hurry through the operations, it is best to open the packet and fill the frame in some room with the blind drawn most of the way down, so as to modify the light.

Although not very sensitive to light, the paper is extremely sensitive to other injurious agencies, to fumes, and to fingermarks. It should, therefore, be handled by the edges only. It does not keep so well as bromide or gaslight paper, and a packet should be used up within a few weeks of opening. On no account must the paper be left in contact with printed matter, as there is something in printers' ink which soon marks it indelibly.

The hinged back with which a printing frame is provided is designed to allow of the inspection of a print during the operation, so that the printing can be carried to the right depth. By opening one half of the frame only, we can draw the paper in that half away from the negative and look at it, while the sheet, as a whole, is still kept in contact with the negative by the grip of the other half. We can close and fasten the first half, and then, in the same way, we can look at the other to see how that part is getting on.

The paper is put into the frame in the usual way, with its coated surface next the image side of the negative, and the back of the frame is fastened up. After doing this, first one half of the frame and then the other should be tried, to make sure that it can be opened and the print examined without causing the paper, as a whole, to shift its position on the negative. Then, having made quite sure of this, it can be put out to print. It is well, at the same time, to see that the springs exert sufficient pressure to keep the paper in close contact with the negative.

Printing is done in good diffused daylight. Direct sunshine should not be used unless the negative is very opaque. The frame should not be put on the ground, on account of damp. The paper contains soluble salts of silver, and a very slight trace of dampness will transfer some of these to the film of the negative, and so give rise to stains which it is almost impossible to remove. In very damp weather, therefore, it is a good plan to hold the negative to the fire for a few moments before putting it into the printing frame. For the same reason, paper should not be left in the printing frame any longer than is absolutely necessary to make the prints. On no account should it be left in contact with the negative all night.

The extent to which the printing has gone is ascertained by opening half the frame, pulling back the paper, and looking at it. In doing this, the frame should be so held that the other half of the back is pressed closely in contact with the negative, to prevent shifting. The examination must not be made in the strong light out of doors, in which the printing is being carried out, at least the beginner should not attempt this, or the whites of the print may become discoloured. A mistake often made is to open the back of the frame and look at the paper too frequently, especially in the early stages, when there is no possible chance of the action being complete. Unless the negative is very opaque, the white paper can be seen distinctly through its most transparent parts, and so long as this does not appear to have darkened it is quite unnecessary to look at the paper by opening the back.

The fixing of a print on self-toning paper is done in a plain solution of hypo, which must not have been used for fixing anything else previously. In the chapter dealing with the development of a negative, the method of making a stock solution of hypo of a strength of eight ounces to the pint was described. This is as strong as any self-toning paper will require. Most of the instructions specify much weaker solutions. With a solution of this kind we can at once make up a fixing bath of any desired strength. All we have to do is to measure out two and a half fluid ounces of the stock solution for each ounce of hypo required, and then add water to bring it up to the bulk specified. On no account must an " acid fixing bath " be used for self-toning paper.

The instructions given with self-toning papers generally specify that the prints are not to be washed before toning; but in some cases a preliminary washing is recommended. The makers' instructions in this matter should be followed strictly.

The hypo solution is poured into a deep dish, and the print is immersed in this face upwards, taking great care, as already mentioned, not to finger the front surface. As soon as it is seen to be well wetted all over and is quite limp, it can be turned over. Prints on collodion paper require a little different treatment. They should be immersed in a comparatively small quantity of the hypo solution, face downwards, and kept so, only turning them over from time to time to see how the toning is progressing. If this is not done there will be trouble with the paper curling up into tight rolls when wet, and it will be impossible to tone and fix it properly.

During the time the print is in the fixing bath it must be kept moving. If the solution rests undisturbed too long, especially if the face of one print is in contact with another, or with the bottom of the dish, the whites may become discoloured. There is in particular a risk of this when a number are being dealt with at once, and for this reason it is best not to have more than half a dozen in the dish at a time, and to use a dish conveniently large.

The paper becomes insensitive to the light very quickly. It is generally quite safe to bring it out into strong daylight after a minute or so, although the fixing is then probably not actually complete. The first visual effect of the hypo is to redden the tone, and sometimes to cause the print to look much weaker. Thereafter, if all is going as it should do, the colour gradually deepens until finally a good brown or purple results. The actual shade of colour obtained varies a good deal with different makes.

It is not always realized that the character of the negative plays an important part in the determining of the colour of the finished print. Very soft negatives, that is to say, those in which contrasts are very slight—the kind, in fact, that give the best prints on ordinary gaslight paper, and the best enlargements—are not the most suitable for self-toning paper. Such material requires a negative with fairly good contrasts, or we shall not be able to get a print of any colour but a delicate brown, and the print will appear weak and washed out. To get rich purple we require a strongish negative, printed deeply, and the print must be left in the fixing bath for some time. Brown tones are obtained by printing lightly, and not toning too far. On this point, as all makes are not alike, the instructions with the paper should be consulted.

Washing can be put in hand immediately the toning-fixing process is over, or, if a number of prints are being dealt with, they can be put, as each is done, into clean water, and then the whole lot washed together. The washing and drying may be carried out exactly as described for gaslight prints, and if they are to have a very glossy surface, they may be squeegeed in the same way.

CHAPTER XVII

Trimming and Mounting

DECIDING HOW TO TRIM—THE TOOLS REQUIRED—USING A SQUARE—THE BEST CUTTING SURFACE—MOUNTANTS—STARCH PASTE—MOUNTING THE PRINTS—PREVENTING CURLING.

TRIMMING a print implies much more than merely removing the edges. The size and proportions of the print have to be determined, not by the size and shape of the negative or of the printing paper, but by the picture, and the photographer who does not realize this overlooks an important factor in his success.

There is a fundamental difference between photography and painting in this respect. The painter or draughtsman puts down what he wishes to include, and anything that lies beyond the boundaries of his composition he leaves out. The photographer cannot do this, or at least cannot do it without giving himself as much trouble to exclude what he does not want as the painter would have to take to include what he did not require. We therefore use a plate or film large enough to include all that is to figure in the picture, and we rely upon trimming the print afterwards to exclude the non-essential. One calls this " trimming," but in this sense it is as much trimming to use a small piece of paper on which to make the print as it is to use a large piece and then to cut it down.

It is one of the characteristics of the beginner to be reluctant to cut down his print. He makes a negative of a certain size and hesitates to reduce a large picture to a small one. It is a very natural feeling. There is a belief in the virtue of mere size which it is difficult to overcome, and it would be hard to convince the average non-photographer that the worker who made a photograph twenty inches by sixteen inches was not a finer photographer than he who could only show one, let us say, three and a half by two and a half inches. Still, that appreciation of mere bigness has to be overcome if the amateur is to make the most of his pictures. He can enlarge if he will, and in that way get work of any size he likes, but the boundaries of the picture should be settled by the requirements of its subject.

When the object of the photograph is merely to make a record of something, as when we are photomicrographing, or copying a document, or illustrating a piece of furniture or machinery, the inclusion of objects that have nothing to do with the work in hand may be a matter of indifference, but even then trimming may make a distinct improvement. In professional work, again, the customer usually regards the transaction as the purchase of prints of a definite size, and there are standard sizes of paper and mounts and albums which have to be adopted. But the amateur is in a different position, especially if he is eager to turn out better and better work, to test himself against his fellows in competitions, and perhaps to exhibit. However simple and unambitious his aims, he, at any rate, has to trim his prints, both in the sense of removing their defective margins and in the wider one of cutting them down to suit his picture.

Such work can be conveniently regarded under two heads—that of the decision what to include and what to cut off, and that of the actual cutting; and it is in this twofold aspect that we will proceed to discuss it here.

When dealing with the decision how to trim a print, we are confronted by the fact that it is a subject on which we cannot formulate hard and fast rules. The worker must be governed largely by his own taste, and the result will be an indication of that taste. He must cut off this part or leave in that, not because he has been told that that is the thing to do, but because he feels the necessity for it. If he does not feel this, his trimming is not likely to be of much effect.

Trimming should not be put off altogether until the print has been made. The first stage of the work must take place when deciding what to include in the photograph. In arranging the subject on ground-glass or finder, one should have a pretty clear idea of the shape of the picture when finished. Work at this stage is often done from a wrong point of view. How often do we see a hand camera user looking in the finder and going nearer and nearer to his subject in order to get it on a larger scale. There are times when this is necessary, but frequently it is a mistake. It is far more important to get the subject well within the boundary, leaving plenty of margin for trimming, than it is to get it as large as possible ; especially when we remember first that no finder, in all circumstances, can be quite accurate, and, secondly, that enlarging the part required is very easily done.

Having made a print from the whole of our negative, we can then decide how it is to be trimmed. The first point to have attention must be the principal object or centre of interest, or, to put it another way, the reason why the photograph was taken at all. It is (not a hard and fast rule but) a fact that in the great majority of cases this should not occupy the mathematical centre of the print. It should come well to one side or the other ; but on the side that it is not, there must be in some manner something to balance it. This balance may be provided by some detail, or may even be a blank. In portrait work it is often nothing more than a plain expanse of background. In deciding what to include, while the balance of the picture must be studied, we must be careful, in endeavouring to secure it, not to admit anything that will compete with the principal subject for attention.

A fault in trimming which is often seen is the inclusion of strong contrasts in subordinate parts of the picture. A strong contrast in a picture provides an emphasis ; it is bound to attract attention, and is therefore used to give due weight and importance to the principal object. If it is allowed in some subordinate part, that part at once ceases to be subordinate. Take, for example, a snapshot open-air portrait. If the background is an unbroken dark mass of trees, extending right to the edge of the picture, the sitter, with due care as to illumination, will take the proper place as the principal object ; but if, as we so often see, that foliage is broken, and through the gaps in it there are visible harsh white patches intended to represent sky, these form strong contrasts with the foliage, and at once become too prominent. Moreover, as such patches of sky are almost always out of tone with the rest, being too white, they help to degrade and flatten the picture, and so are better cut off.

Another matter which must have attention is the position of important points in the subject matter. If we look at almost any picture, no matter what it may represent, we cannot fail to note that in it are a number of quite definite points. For example, in portraiture there are the extremities of the figure or of prominent accessories, such as the feet or back of a chair, the corners of a book that is being held, and so on. In a landscape there will be perhaps the top of a tree, or the extremity of a spire, or the end of a ship's bowsprit. In deciding how to trim we must be careful not to get these exactly upon the edge of the print or even just in or just off. Either they must be well inside the margin or else should be cut right off. In architectural work, when dealing with a lofty building, it is sometimes very difficult to include the extreme top, but we must realize that, however desirable it may be to show it all, it is far worse to get it just within the boundary than to have it right out of it. Points which fall in parts that are altogether subordinate may sometimes be allowed to touch the edge, but even then it is better to avoid it whenever possible. A landscape with a number of cattle grazing in a field, for instance, is better trimmed so that none of the cattle, however small and insignificant they may be, come just on the edge or margin of the print.

It is little things like this which often show a judge whether the photographer is really able to trim his print properly or not, since it may be plain enough that the mere removal of an eighth of an inch from one side or the other would make a great improvement ; and if this, although obvious, has not been done, then it is plain that the photographer cannot have given the consideration which he should to this important subject.

When the picture has for its subject something in motion —as, for example, a river scene in which the principal object is a vessel under canvas or steam—then in deciding where to trim we must be careful to include sufficient space in the picture in front of the moving object. That is to say, it must appear to be sailing into, and not out of, the picture. If we place it so that it is not just central—as, of course, we shall do if it is the principal object—then we must put it on that side of the centre from which it is moving ; if otherwise, it will have a disturbing effect on the composition. For a similar reason, in portraiture the sitter must be looking into and, not out of, the picture. Thus, for example, in a profile portrait the back of the head may come near the edge—it may even be partly trimmed off, but in front of the eyes there must be an ample space.

If we have the misfortune to have a print in which, owing to the camera not having been level, there is distortion, it can sometimes be hidden, or at least made unobtrusive, by distributing the distortion. A vertical line which is rendered as a sloping one, may either be kept away from the edge, or may have the edge cut parallel, or nearly parallel, with it, the opposite edge not being quite parallel with the first. On a large mount this may easily pass unnoticed, whereas a strict squaring up of the print would have made the distortion prominent. A horizon line that is sloping should always be put right by trimming.

Having decided just what portions of the print are to be removed by trimming, the next step is to carry it into effect. There are some gifted workers who can take a print and straightway with knife or guillotine cut it down to suit their ideas ; but most of us have to proceed more deliberately, by studying the possibilities of the picture in the first place, and then, having made our decision, marking off what is to be removed, and finally doing the actual cutting.

For such work, it is best to provide a couple of sheets of mounting paper at least double the size of the print in both directions, a sharply-pointed pencil, a trimming-knife, a metal straight edge, a triangle of celluloid such as a draughtsman uses and calls a " square," and a sheet of cardboard or linoleum on which to do the cutting. In place of the knife, etc., we may use a guillotine print trimmer, although for my part I prefer the knife, unless the trimmer is a very good one. The cheap trimmers are either unsatisfactory from the start, or soon become so.

Two mounting papers should each have one quarter of their area cut away, so as to leave them of the shape of an L with thick squat lines. By putting the two of them over the print, so that its picture is bounded by the sides of the two openings cut in the papers, we can then slide one of the mounting papers over the other, so as to make the opening larger or smaller at will, studying thus how to trim the picture, until we finally decide just what it would be best to include. When this has been done we can make a faint pencil dot at each corner of the picture. The indication which is afforded by these pencil dots is then elaborated by the help of the square, ruling four pencil lines on the print to indicate where to cut. These lines should be drawn so as to come just outside the picture and be cut off.

It is important, of course, to get the angles exactly true. Two sides of the square meet at a right angle, and it is these two sides for which in trimming a print we have the most use. If there is a definite and fairly conspicuous horizontal or vertical line in the picture, which must be kept horizontal or vertical as the case may be, the square must be put down on the print so that one of the sides forming the right angle exactly coincides with this line in the picture. The celluloid being transparent, this is easy. Then, holding the square firmly on the print, the straight edge is brought up against one side of it, and when it is in contact with it all along, the straight edge in turn is held firmly while the square is slid along it until the edge at right angles to the straight edge just comes against one of the dots which indicate a corner of the picture. The square is then held while the straight edge is brought up against its other side; and then, the straight edge being held, the square is again slid along it, but this time in a direction at right angles to that of its first motion, until its edge comes against the dot diagonally opposite the first. Holding the square in that position and taking away the straight edge, it will be seen whether the point of the right angle of the square just touches another dot on the print. It will do so if the original marking out of the print was exactly square with the picture, as, of course, we endeavoured to make it, at least approximately. If the coincidence of the dot and of the angle of the square is close enough, we can run the pencil along the square and so mark out two sides of the print.

To mark out the other two sides, we hold the square firmly after ruling the lines, and bring up the straight edge against it once more. Then, holding the straight edge, we turn the square over, and still keeping the same side of the square in contact with the straight edge, slide it along until it just reaches the other corner indicated by the dot. We then hold the square while we transfer the straight edge to the other side of it, hold the straight edge there while we again turn and slide the square, and then removing the straight edge, we can mark out with pencil the remaining two sides.

This operation is more complicated in the description than in the reality, as anyone will see when once he has carried it out with this before him. I could have marked accurately a dozen prints or more while I have been writing this. A good many will already be familiar with the operation. For the benefit of others, however, it may also be pointed out that by holding the straight edge against the third side of the square—that is to say, the hypothenuse of the right-angled triangle which forms it—the square can be slid along a straight edge diagonally, still keeping its two sides parallel with their original position, so that in that way the square can also be serviceable.

Cutting a clean straight edge to a print is an easy operation to anyone provided with suitable tools, and a very difficult one without them. The tools are a knife with a sharp point, a smooth surface on which to cut, and a straight edge to guide the knife. Special trimming knives figure in price lists, and there have been articles describing how to grind down a shoe-maker's knife for print trimming, but a pocket knife of the ordinary kind does just as well as any other, provided it is kept sharp. For this purpose an oilstone is a necessity. This need not be a big one, and can be bought for a few pence at any tool shop.

To sharpen the knife, when once it has been sharp, does not need the rubbing away of much metal. Half a dozen strokes on each edge should be sufficient, taking care to hold the blade fairly flat on the stone, and at exactly the same angle from beginning to end of the stroke. A drop or two of machine oil should be used on the stone, and when the surface gets gummy the oil should be cleaned right off with a rag and a little paraffin, and some fresh oil applied. The knife should be sharpened after trimming each dozen prints or fewer, and wiped clean from oil to avoid messing the print.

The best straight edge is a steel rule, or if what is called a " mason's square " is obtained—it is a steel triangle, with an opening in the middle, and one of its angles a right angle—an ordinary wooden foot-rule can be used with it ; the two will serve both for marking out the print and cutting it. The edge of a piece of glass can be used as the cutting guide. A cleaned negative is all that many photographers use, and some prefer not to clean it, as the gelatine film prevents it from slipping on the print. If glass is preferred, a piece should be chosen the edge of which is quite smooth and straight. Glass is often very rough on the knife, unless the guiding edge of the glass has been ground smooth, so that a steel guide is much better. It is better to use a proper square for these operations than any old negative that happens to be at hand, as is so often done. The special glass cutting shapes are often anything but straight and true. The polishing of the edges seems to have had a detrimental effect in this respect.

A piece of smooth card makes an excellent surface on which to do the cutting ; but after a good many prints have been trimmed on it, it gets rough, and should be discarded, or it may make the edges jagged. Wood is unsuitable, as it tends to catch the knife in its grain and to carry it away from the guide. Zinc, which is sometimes recommended, is very bad for the knife, and when it gets roughened, as it soon will do, it is quite useless if we are to make a clean cut. Linoleum makes a nice surface, but it is open to the objection that it soon blunts the knife.

The actual cutting hardly needs description. The straight edge is held down firmly on the print, using the fingers of the left hand, the straight edge being on the part of the print which is to remain in the picture. It is adjusted so that the pencil line can just be seen, and then the knife is drawn along it so as to remove a strip in one cut. The knife should be so sharp that hardly any pressure is needed. The print must be quite dry, or the edge may gather up and the cut will look like a saw-edge.

In trimming a print it is best to hold the knife at an angle, not precisely vertical. It must be sloped forward—that is, in the direction the cut is being made—as it will then cut more easily. It should also be sloped with the handle outwards—that is, away from the print—so that the point of the knife is actually slightly underneath the cutting guide. This will give the edge of the print a bevel which is a help when a print is to be put on anything but a white mount. If this is not done, we shall see a white line, the vertical edge of the paper, all round the print, which against a dark mount may be too conspicuous.

In making the cut we must be careful to have the cutting guide well pressed down towards the point at which the cut finishes, or a little of the corner may get torn. If there is any tendency to do this we can prevent it by pressing on the edge we are going to cut off with one finger of the hand that is holding the guide, or all four cuts may be made long enough to clear the print, but not long enough to cut a strip right off. The paper we are cutting off will then not be detached from the print until the fourth cut is completed.

When a guillotine is used the operations are a little different. The print should be pencilled in the way described, and each cut made by working to the pencil line and not by the guide on the guillotine. If the guillotine does not give a clean cut, but tends to double up the print, it can sometimes be made to work properly by pulling the handle of the knife towards the board slightly while making the cut. But there is a good deal of leverage when the handle is a long one, and the practice will rapidly make the guillotine worse.

The edges of the trimmed print sometimes have a slight curl on them. This can be got rid of by drawing the print between the fingers, and it is then ready for mounting.

Amongst mountants, nothing is better, if paste is to be used at all, than one of the preparations specially made for photography. It is unwise to use a ready-made adhesive, unless it is guaranteed by the maker to be suitable for mounting photographs, since it may contain some ingredient—such as a preservative, for example—which in course of time would attack the photographic image, and give rise to fading. One sometimes sees old photographs which have been mounted on cards by pasting at the edges only, which have faded for just so far as the paste was applied, and not beyond that point.

If some of a special photographic mountant is not obtainable, then a home-made starch paste can be used. For this purpose, ordinary laundry starch will serve, or, failing that, flour. The paste must be properly made so as to be free from lumps. It is best to make a little from time to time as it may be required, since it soon becomes sour and is then useless. Twenty-four hours may be regarded as the longest time which should elapse between mixing and use.

To make the paste, about half a teaspoonful of starch should be well mixed up into a thin cream with cold water. This can be done in a cup with a spoon, stirring and squeezing the starch against the side of the cup until it is thoroughly incorporated with the water and is perfectly free from all lumps. When the cream has been made, a basin capable of holding about a pint will be needed, and a kettle of boiling water. The water should be actually boiling, not merely hot, and the basin should be filled with it and left for a minute for the earthenware to get hot right through. Emptying out the basin the cream should be poured into it, and then, with constant stirring, boiling water added until the whole mixture " thickens." This thickening is a curious property of starch, and is due to the bursting of the skin of the starch particles and the action of the hot water on their contents. When it takes place, the mixture becomes much thicker, and, instead of being white and opalescent, turns almost clear. Enough water should be added for the thickening to be thorough, but it is important not to add more than is really necessary. It is to reduce the amount required that the basin is warmed before use. A very wet paste is more evenly applied, but tends to make the print curl. After thickening, the starch is put on one side to get quite cold, and, after removal of any skin that may have formed on its surface, is ready for use. It ought to be perfectly smooth, but if there should be any lumps in it, it may be squeezed through a piece of fine muslin to get rid of them.

Before attaching the print to the mount, its correct position should be marked on the card, because it is impossible to slide it about on the mount without getting some of the paste on the front. It is best to measure the margins unless the photographer has a very accurate eye for such work. There is no need to rule lines on the mount; two fine dots made with a pencil, or two pricks with a needle, are sufficient. They should be so placed that when the print is put down correctly, they are just covered by the ends of one of its longer sides.

Although we sometimes see photographs intentionally mounted out of the centre of the card, the effect is never satisfactory. It is apt to look affected. But while the margin of card visible on each side of the picture should be the same, it will not do to have an equal width at the top and bottom. More space should always be left below the picture than above it, or it will have the appearance of having slipped down.

Having marked on the mount the position which the picture is to occupy, we can proceed with the actual sticking down. We shall require a number of sheets of clean paper—newspaper will do—as large as the mount. Putting the print face downwards on one of these, and holding it with the extended fingers of the left hand, a little of the starch paste is rubbed or brushed on to the back. The paste should be used sparingly, and may be applied with a stiff brush, although for small prints the fingers are perhaps better than any brush for the purpose, as one can feel how the application is getting on.

The rubbing must be sufficient to carry the paste into the pores of the paper, and should be continued until the whole print feels limp. Special attention must be given to the edges and corners, not only to make sure that they are properly coated with adhesive, but also to guard against any of the mountant getting on the face of the print. To insure against this we must be careful that the print does not shift on the paper in the slightest; and when the rubbing is carried right off the edge, as it must be if the edge is to be properly pasted, each stroke of the brush or of the fingers must be directed straight off the print, not parallel with the edge, and still less, not from the paper on to the photograph.

As soon as the limp stage is reached, the fingers, if the paste has been applied with them, must be wiped clean and the print picked up by putting the point of a knife under it. It is then put in position on the card, taking care first to put down that edge the place of which is indicated by the dots. If this is adjusted the rest of the print may be allowed to fall into position. It is at once covered with another piece of paper, and well rubbed down into contact with the fingers, or with a roller squeegee, once more giving special attention to the edges and the corners.

The most likely cause of trouble in mounting is the application of too much paste. This not only increases the risk of getting some on the front of the print when it is being applied, but of some squeezing out as the print is rubbed into contact. If any at all does so it is a clear sign that too much has been used. Too much or too wet paste also increases the tendency to curl as the print dries. This curling cannot be prevented altogether with any form of wet mountant, but by working on the lines described it can be kept to a minimum.

When the print has been rubbed down, the paper may be removed to make sure that none of the paste has oozed out ; a piece of clean paper, preferably without any printing on it, may be put down upon it, and the mounted print put aside to dry under gentle pressure. This is easily obtained by shutting it up in a large book, with a second book on top of it.

One book may be made to hold a number of mounted prints, a few pages being allowed to intervene between each one and the next. To equalize the pressure, where a number of mounted prints are put into a large book, each print should be put on the same part of the page, so that they all come one above another. It is best to leave them like this for at least twenty-four hours ; three or four days is usually long enough to ensure complete drying.

The process known as " dry mounting " is in many ways better than any form of pasting. A sheet of thin paper impregnated with certain resins is put between the print and the mount, and heat and pressure applied, which cause mount, paper and print to adhere closely. As no moisture is present, the mounted print has no tendency to curl. Small prints can be mounted in this way without any special apparatus at all, the only material needed being some sheets of dry-mounting tissue, which can be bought from any dealer. They should be at least as large as the untrimmed print. The pressure can be applied with the domestic flat iron.

To mount a print, a piece of the tissue is laid on the back of the untrimmed print, and the middle is momentarily touched with the iron, which will cause print and tissue to adhere in that spot. The print and tissue are then trimmed together. The print is next adjusted in position on the mount and when it is in exactly the right place, it is held down with a couple of fingers of the left hand, while it is lifted away from the mounting tissue which is again touched with the hot iron. This causes the tissue to adhere to the mount, and so prevents the print from shifting its position. The print being then covered with a clean sheet of paper, the iron is pressed down upon it, so that print, tissue and mount adhere closely all over. The iron is not slid about as in ironing, but pressed firmly in one place and then moved to another, if it does not cover the whole print at once. In this way quite large prints can be dry-mounted.

The crux of the process is to have the iron at the right heat; if too hot the print comes away from the tissue, if too cold the tissue does not adhere to the mount. The correct temperature can be found by trial. If the iron stands for a minute or two in a saucepan of water that is actually boiling it is brought to exactly the heat required.

When the prints are to be kept in a portfolio, or under pressure in any form, a neat and effective method of mounting is to touch them with adhesive on the two top corners only and place them in position. The objection to this plan is that unless the print has been well flattened before mounting by drawing it under a straight edge, and unless the mounted print is stored under some gentle pressure, the print will curl away from the mount. If it is to be framed, or put in a *passe-partout*, or temporarily exhibited under glass, or kept in a portfolio, this method of mounting is all that is required.

CHAPTER XVIII

Preparing Negatives for Printing

Spotting the Negative—Printing with a Mask—Fancy Masks—A Modified Printing Frame—Clearing up Discoloured Margins—Making Vignettes.

THE actual processes of making a print have been already described, because it is probable that the novice will be anxious to make prints as soon as he has made negatives. But when a negative has been washed and dried, it does not follow that it is ready to be printed as it is. It will often happen that by slight modifications of one sort or another it can be made to yield an improved result, and even if the beginner feels a little doubtful as to the wisdom of an attempt to improve it in any wide sense of the word, he will at least admit that it will be better if any pinholes or similar trifling defects are taken out.

The process by which this is done is termed " spotting," and it can be applied both to negatives and to prints. As the method of working is very much the same in both cases, the following hints will serve also when we come to deal with the spotting of prints. It is usual to do the spotting on the negative in the case of transparent spots or pinholes, and to do it on the print in the case of any light marks on it, due to opaque spots on the negative. Such opaque spots, when they occur before the negative has been printed, are usually caused by undissolved particles in the developer ; when they occur on the negative after a print has been made, they may be due to damp being present when the negative has been in contact with a printing paper, such as p.o.p., which contains a soluble salt of silver.

Transparent spots are more likely to occur, and may be due to several causes. The most common source of such blemishes is dust on the surface of the film at the time of exposure. Dusting the plate is no preventive, because we may be pretty sure that there is no dust on its surface when we take it out of the box. Except in a modern hospital, no room is likely to be met with anything like so free from dust as the rooms at a plate factory in which the plates are coated and dried. The dust settles on the plate after it is put in the camera or dark slide. Contrary to common belief, such dust on the film or plate at the moment of development does no harm, the developer washes it off at once. It is during the exposure that the mischief is done, each opaque dust particle screening the spot of emulsion behind it, causing this spot to be transparent in the finished negative. Owing to their small size, such spots are often unnoticeable until the negative is examined in daylight. A multiplicity of fine "pinholes" due to this cause cannot be taken out, the labour involved would be too great. The best thing to do is to make the print on a rough paper, so that they may be unnoticeable.

Larger holes must be filled in by spotting, and it is curious to note how difficult some photographers seem to find this really simple process. The difficulty arises from a failure to realize how little pigment is required, and how very dry the brush should be. A brush that is too wet, instead of filling up the pinhole, generally leaves it bare, with a black ring round it, which makes it more conspicuous than ever.

Water colour is generally used for spotting ; moist colours in little pans being a convenient form. The actual pigments required will vary according to the colour of the image to which the paint is to be applied, and often there are several different mixtures of colours available to get the same shade. Ivory black, burnt sienna, and Payne's grey will be found a very useful trio, by mixtures of which almost any colour of image likely to be found in a negative or print can be matched. Sets of spotting colours are made up and supplied by most dealers. We also need a porcelain palette—a piece of broken plate makes a good substitute—and a fine camel-hair brush or two. Sable brushes are expensive, but more satisfactory. A more important requisite than any of these, however, and one the want of which makes spotting more difficult than it should be, is a proper support for the negative.

A retouching desk is the ideal, of course, but few amateurs would feel justified in buying a retouching desk for the little spotting they have to do. One can make shift with a very simple substitute. A board with a hole in it slightly smaller than the negative, with a rim round the hole to keep the negative from shifting, can be used. Or we may employ a sheet of stout glass, with a piece of card on it with an opening just large enough to take the negative. Whichever it is, it must be supported in such a way that, while as little light as possible falls directly upon the film side of the negative, we can look through it at a strongly illuminated white surface. For spotting, it does not matter much whether the negative is supported horizontally or at an angle as in a retouching desk. We can prop up the glass or board holding it on the table in front of the window, putting a sheet of white paper below it. Or we can support it horizontally on the table by means of books at its ends, and putting the paper below it, place a lamp where it can shine on the paper, with a screen so that it does not shine on the eyes or on top of the negative.

When the negative is supported in this way, it can be seen at a glance when the pinhole is filled up. A little of the colours necessary to make a good match with the image are transferred to the palette and well mixed together ; a very little indeed will be required. There will be some transparent part along one edge of the negative on which the colour can be tried. When a match has been obtained, the brush should be dipped in water and then in the pigment, so as to have it very weak, after which it should be held almost flat on a piece of paper and twizzled round, drawing it along meanwhile in the direction away from the tips of the hairs. This will give it a fine point, and when it has almost ceased to leave a mark upon the paper, the point may be just touched on the negative. The clear spot, if a small one, should at once disappear. If it does not, a moment may be allowed for it to dry, and then it may be touched again with a brush a little stronger in pigment if necessary.

There must be no attempt to paint over the hole ; the colour must be applied by a mere touch with the tip of the brush. If the spot is too large for one touch to block it, then several close together may be given. The aim should be to bring about so good a match with its surroundings that the pinhole is no longer visible.

A scratch may be dealt with in much the same way, but it may be necessary to paint a little gum on it and allow it to dry, to provide something to take the colour. Then a series of dots may be made along the line of the scratch, some little distance apart first, and then intermediate dots, to prevent all chance of the colour running.

The picture on the negative must include all we wish to show in the print, but, unless by some rare chance, it is sure to include more. The print, if it is to look well, cannot go right up to the edges of the negative ; it must be trimmed in some way so that all the picture that it shows is perfect, right up to its edges. One way is to cut down the print with a knife and straight edge as described in the previous chapter ; another is to mask the negative. By masking the negative we get a print the size of the piece of paper we employ, but it bears only so much of the picture as can be seen through the mask, the rest being white margin. Packets of sensitized postcards often contain masks for this purpose ; but when they do, they nearly always have openings of fancy shapes—ovals, " domes," round-cornered rectangles, and some even in the form of ivy leaves, hearts, etc. The best mask is one with perfectly straight edges and square corners.

The user of a camera of any size from postcard or 5 × 4 downwards will find that the most convenient method of making masked prints is by the use of a whole-plate printing frame. Having got such a frame, the first thing to do is to fit it with a piece of clean glass of good quality, which can be fastened into position by two strips of paper 8½ in. long by 1 in. wide. These are folded long ways and then attached by means of seccotine in the angle between the frame and the glass, where the back of the frame fits in. Upon the glass is fastened in the same way a piece of card the full size of the frame, a little thinner than the glass of a negative, and with an opening in the centre of it just large enough to take the negative and keep it from sliding about on the glass.

It remains to make the masks. For this purpose some thin black opaque paper is required. This can be bought from any of the large photographic dealers, or the black paper from roll-films or packets of plates or papers can be used. Opaque paper is a very useful article in photography, and whenever any is found amongst the packing of sensitive materials, it should be handled carefully so as not to get it torn or pierced, and then smoothed out and put away for use. The piece of paper chosen for the mask should be a little larger than the paper on which the print is to be made.

A rough print may be made from the negative, showing the whole of it, and this may be kept as a record of what is on that negative. A catalogue of negatives may take the form of a slip-in album containing such a series of rough prints. Looking at this print, we can decide how much of what is on the negative is to figure in the print, and so what size to cut the mask. Having settled this, we can rule upon the opaque paper four lines to represent the four edges of the picture. Just as much care must be taken to get the angles of these lines exact right angles as would be used in trimming the print.

The next proceeding is to cut the mask. Before doing this it is well to see that the pencil lines we have ruled go well beyond the corners, or, when the cutting guide is in position, we shall not see where each cut must begin and end. Lead pencil, it may be noted, is easily visible on black paper. The cutting is done with the point of a knife, which must be carefully sharpened on an oilstone until it will cut a piece of paper by being wiped across it almost without any pressure at all. A pocket knife does quite well. The black paper must be put on a piece of card, or on a pile of smooth paper, such as a magazine, for cutting, and a steel rule may be used to guide the knife.

Anyone who is unaccustomed to cutting masks may find the corners rather troublesome at first. There are two easy ways of dealing with them. One is to make each cut just a little shorter than it need be to meet at the corner, and then, when all four cuts have been made, to complete them by removing the cutting guide, putting the point of the knife at the corner exactly, with the blade in line with the cut, and giving one straight dig. When this has been done all round, making eight in all, the piece of paper in the centre should drop out. The other way is to make each cut a little longer than it need be, so that the middle comes away, and then to stick a scrap of black paper diagonally at each corner, so that each piece of paper, which need not be bigger than half a postage stamp, just covers up any part of the cuts that may extend beyond the corners.

Having thus made the mask, there should be marked on it, which also may be done in pencil, the position to be occupied by the sensitized paper or card. It is better to do this than to have to trim the print afterwards in order to bring the picture into its proper place.

As in mounting, the picture should not be in the mathematical centre of the print, or it will look wrong. The margin should be equally wide on each side, but it should be wider below the print than above it. Accordingly the position of the sensitized paper is measured off and marked in pencil; and if the printing is to be done on postcards, the top may be marked so that the picture on one side may be the same way up as the address or lettering on the back.

Putting the negative into the opening in the cardboard, the mask is arranged on it until the picture is seen correctly through the opening, taking care that the top of the picture comes against the part marked " top " on the mask. If there are a number of prints to be made from that negative, all with the mask, it will save time in adjusting if the mask is attached to the card at one edge with scraps of gummed paper.

Having made these preparations, we are in a position to make the prints, with the assurance that each will appear in the correct position on it, and with a neat white margin. It is very little trouble to do all this, and it is certainly repaid by the enhanced appearance of the print. Masking is most often adopted when the printing is to be done on postcards, and the pictures are not to be mounted subsequently. But even if they are to be trimmed and mounted, they often gain very much by being printed with a mask, and then trimmed so as to show just a narrow edge of white all round the picture.

There is a little dodge in connection with printing with a mask which is sometimes very useful. From over-development or some other cause, the negative may have parts of it which come against the mask and are so dense that in the print the line of the mask is lost; the picture in those parts is as white as the margin. By a little dexterity and care this can be got over by exposing under the negative in the ordinary way first, and then opening the back of the printing frame, keeping the fingers of one hand pressed on one end of the paper so as to prevent it from shifting on the mask, while the negative itself is slipped out. The back of the frame is then replaced, and a very brief exposure indeed is given to the paper, with the mask but without the negative. Just enough to give a very faint tint is all that is necessary.

Making gaslight prints with perfectly clean white margins is a test of technique, and the beginner cannot do better than determine to get such, and if the margins are not as clean as they should be, to find out the cause and remove it. But if the cards have been badly kept, or were inferior in quality, it is possible that while the picture on them is as clean and bright as one could wish, the margins are not.

A reducing solution affords a simple means of clearing up such dirty margins, but it must be used with care, if the picture itself is not to be injured. The proper time to apply it is after the prints have been fixed and washed in at least half a dozen changes of water, with due draining in between, as elsewhere described. A crystal of potassium ferricyanide, not larger than a split pea, may be crushed and dissolved in a couple of ounces of water. Equal parts of this and of a plain solution of hypo of a strength of two ounces to the pint are mixed together immediately before use. It is well to try the strength of this reducer upon a spoiled print, as if it is too strong it may spoil a good print before we realize what it is doing.

To apply the reducer, the wet print is put face upwards on a piece of glass, close to a running tap or a big vessel of water, and a tuft of cotton wool dipped in the reducer is mopped quickly over the margin of the print, and the solution at once washed off by holding it under the tap or swishing it about in the vessel of water. If the first application does not quite clean up the margin—and it is better that it should not do so—we may give a second and third, and so on until it is perfectly white, taking care not to get the reducer on to the picture at all, or at least not on to any of the lighter tones in it. The same solution will do for several prints, but after it is once mixed up it soon loses its power, and in ten minutes or so a fresh lot will be necessary. After clearing the margins in this way, the prints must be washed just as thoroughly as if they had not been washed at all.

This method of getting clean margins by reduction is tempting, but it should only be used as a makeshift. If it is necessary at all, it is a sign that there is something wrong, and the proper course to follow, if we wish our prints to be as good as we can make them, is to find out what that something is, and put it right.

If the mask, instead of being between the negative and the paper, is put outside the negative altogether, the edges of the margin are no longer sharp, but softened and diffused; except in the case of a film negative, the thickness of which is not sufficient to make any appreciable difference. The extent to which they are softened depends upon two factors—the separation between the mask and the negative, and the diffusion of the light by which the printing is done. When the mask, instead of being rectangular with straight boundaries, has some other shape, maybe quite an irregular one, and the edges are very diffused indeed, we get a style of print called a vignette.

To make a vignette, the first thing to decide is the outline of the parts that are to be included in full strength. This should not be a formal oval, or any other regular pattern, regardless of the subject of the picture. In a portrait, it may follow the outline of the head, where it comes against the light background; but elsewhere must be governed by what is on the negative. The outline is made by putting a piece of tissue or tracing paper on the negative, preferably on the glass side to avoid injuring the film, and then drawing it in pencil. A second outline may be drawn outside the first, indicating the extreme extent of the softened image. For a quarter-plate portrait these two outlines will possibly be half an inch or more apart; where the head comes against the background half an inch may be taken as sufficient.

Transferring with the help of carbon paper the two outlines to a sheet of thin card, at least as large as the outside dimensions of the printing frame, the inner outline may be cut out with a knife or pair of scissors and the piece of card removed. Then, with a pair of scissors, the outline of the opening so left is cut with a saw-tooth edge all round, the V-shaped pieces cut out being as narrow as possible, and extending right up to the second line, It will do no harm if some go just a little beyond. A piece of tissue paper is stuck over the opening so made in the card, and the vignetter is ready for use.

Putting the negative into the printing frame, we hold it up to the light, and, looking directly at the negative, we adjust the vignetter (on the outside of the front of the printing frame) behind the negative, until the opening in it is exactly over the part of the picture to which it corresponds. When this position is found, the card is fastened to the printing frame with a couple of drawing pins or dark room pins. If the printing frame is very thin, or if an extremely soft outline is required, it may be necessary to increase the separation between card and negative by attaching a frame of thin wood or very thick card to the printing frame, and using the card outside that; but there is usually a gap of half an inch or more, which is enough.

If the printing is to be done by daylight, all we then have to do is to make the print, taking care to do so in diffused light, and not in direct sunshine, and also to turn the frame so that it faces squarely towards the quarter whence the light comes. The notched edge of the vignetter, and the tissue paper, together with the separation of the card from the negative by the woodwork of the printing frame, will give the softened outline, which is what we require. But there may sometimes be some almost transparent patch on the negative in some part which is not to appear in the picture, and there may be enough scattered light under the card for it to leave a trace. An easy way of preventing this is to push in some cotton wool between the negative and the card in that place. The pink cotton wool is better than the white for such a purpose, as it stops the light more effectively. It should be frayed out a little on the side next the picture, and must not encroach upon the opening in the card.

When vignettes are to be made on gaslight or bromide paper, it is necessary to take certain additional precautions. The light generally employed is much more direct, and, in consequence, the notched edges, the tissue paper, and the separation may not be sufficient to give a soft edge ; it may even happen that the notches in the card show themselves in the print. To avoid this, there should be some diffusing screen between the light and the printing frame, such as a sheet of ground-glass or even of tissue paper. The printing frame should not be held still during printing, but wobbled by using the wrist as if it were a ball and socket joint, so that the angle at which the light falls upon the vignetter is constantly altering. By attention to these points it is as easy to make soft vignettes on gaslight or on bromide paper as on p.o.p.

Vignettes have sometimes been made in which the picture passes into a dark background instead of into a light one. The principle is the same, but the method of applying it is different. The portrait must be taken with a dark background to start with, and strong high lights in the part to be vignetted off should be avoided. The vignetter is then used when making the negative, instead of when printing, a blackened card with a suitable opening being placed either inside the camera, or between the lens and the sitter, whichever is more convenient. But such effects are more curious than beautiful.

CHAPTER XIX

Printing Defective Negatives

SMALL REPAIRS ON A NEGATIVE—FILLING IN HOLES—MAKING A NEW NEGATIVE FROM A WORKED-UP ENLARGEMENT—WORKING UP—THE USE OF BODY COLOUR.

THERE is one type of question more often put to me than any other. It concerns some negative which the enquirer values greatly and is quite unable to repeat, and which from some cause or another has become damaged: and the question is whether it can be "restored." Sometimes I am asked to recommend a firm that will undertake the work.

The answer to such enquiries may be summarized by saying that all such restoration resolves itself into painting or drawing—retouching is merely a form of drawing—and that inasmuch as a drawing can be made without any photography at all, there is no damage whatsoever that cannot be made good in this way, provided one has the necessary skill with pencil or brush, or is willing to pay for it. What has to be remembered is that just so far as the photograph requires this handwork on it, to that extent will the result cease to be a photograph; and the extent to which it ceases to appear a photograph will depend upon the skill with which the work is done and, to some extent, the character of the subject. Damage on the face of a portrait, for example, is likely to involve the loss of some of the photographic character of the result, whereas damage to an architectural subject, and still more to a landscape, might be repaired without anyone being the wiser.

To carry out such work by retouching on the negative is not a task within the power of the beginner at all. Even the simplest form of retouching calls for skill, and skill only comes with practice, while retouching as commonly understood is not a process intended for such a purpose, but merely to remove slight blemishes and to soften down little irregularities in the skin, which the photographic process has exaggerated. The beginner who attempts to use retouching for anything more than this, finds that he cannot get enough blacklead on to the negative to do what he wishes. In fact, most photographers who attempt retouching are surprised at first to see how very little the pencil will affect the film, and they only learn by degrees that the most elaborate retouching by a skilled professional often leaves hardly any visible deposit on the negative.

Retouching is not the method for such repairs as we are now considering, and, even if it were possible to use it, there is still the difficulty that retouching has to be done backwards. That is to say, we have to darken the negative where we wish to lighten the print, which makes it difficult to realize when we have done enough to give us the desired result. The simplest and most satisfactory plan is to make a print, to work on that, and then to rephotograph it, and the extent to which this can be done successfully depends entirely upon the photographer's skill with pencil and brush. It is curious to note how some workers, who are extremely dexterous with strictly photographic processes, seem unable to carry their intentions into effect when they have to use the painter's tools. It is not a subject that can be taught; it is one of innate aptitude developed by practice. Whether the reader can succeed in doing such a job as I am going to describe will depend on that alone, and will have nothing to do with his knowledge of photography as such.

Let us suppose we have a cherished negative, which by some unlucky chance was knocked against the nozzle of the tap during the process of washing and, a piece of the film removed altogether, leaving a patch of clear glass which shows as a great blob of black on the print. Many such negatives are thrown away as failures, when they might quite possibly be utilized. The first proceeding is to make a print on which to work. It is best for more reasons than one that this print should be an enlargement, and if we make it of about three diameters it will be enough. If the negative is a 3½ × 2½ one, we therefore make the enlargement about 10 × 8. In making it we must see that we get the exposure absolutely correct, and develop fully, for any loss of gradation which will result if this is not done, will go to reduce the quality of the finished result. The enlargement should be on semi-glossy or on platino-matt paper, the latter for choice, as it is not so easy to put work on a glossy surface that will blend with the photograph.

As it is usually easier to darken down a light patch on a print than it is to lighten a dark one, the hole on the negative may be blocked out with opaque pigment before the enlargement is made. The pigment may be Indian ink, or ivory black water colour, or one of the special preparations sold for such work—as, for example, Photopake. If the paint does not take on the glass, a drop of gum water may be put on and allowed to dry before applying the pigment, or we may even cut out a little patch of paper and stick that on. Another way is to take a scrap of sheet gelatine, soak it until quite limp, and then put that on the place and allow it to dry. Still one more method is to use a little Brunswick black, which will take on the glass well enough. The result shows the missing part represented by a white patch. There is no need to trim the enlargement, but it should be mounted on a stiff card, and put under pressure until it is dry, so as to come out flat. It is then ready to receive the handwork.

If the work is to be done in pencil, it is well at this stage to give the photograph a slight tooth, although with a platino-matt print this is not a necessity. The tooth is given by dusting a little pumice powder over the surface, and then giving it a grinding in with a finger tip, brushing off the powder afterwards.

The exact nature of the handwork will depend on the character of image which we have to supply. If it is a patch of sky, with no definite details at all, a little pencil shading may be found sufficient. The enlargement should be covered over with a sheet of paper, with an opening in it a little larger than the area we have to doctor, as this is both a protection to the photograph and a help in doing the work. Then with a soft pencil—say, BB—cut to a fine point, we go over the white patch, working tentatively, starting at one edge and gradually carrying the work away towards the middle. We must be careful not to make it too dark: it is better to have it too light, and then gradually to tone it down, until we can no longer see where the image leaves off and the lead-pencil begins. The white area will thus gradually diminish, until at last the whole has been filled up. The best way of doing this is by a fine shading, giving the lines no particular direction, and making them very fine and close together. Anyone accustomed to free-hand shading can do the work with a series of straight lines; but without practice it is not so easy to get a uniform tone in this way as it is with the irregular line. The subsequent rephotographing will be found to cause the lines to blend, and their mechanical character should not then be noticeable.

If it is not a patch of sky which we have to provide, but actual details of a landscape, these details must first be very faintly outlined with a pencil as a guide to the subsequent shading. The lines must be so slight as to be quite invisible when the work is finished, as a characteristic of the photographic image which we are imitating is that it has no outlines, but is made up of areas of tone, which we have to provide by shading. Irregular foliage is the easiest to deal with, as with it any slight departures from truth may easily be overlooked.

The parts of the work that must have the greatest care will be those at which the photographic image meets the drawn-in image. When the work is complete, the blemish should have become altogether invisible when the picture is looked at from a distance of some four or five feet. Instead of with pencil, the work may be done with a stump, or perhaps with a brush and water-colour. The colour of the image must be matched, which can only be done in good daylight, taking care that the match is reached when the pigment is dry. A frequent fault with water-colour is using the brush much too wet. No attempt must be made to apply a wash of colour. It can be done, but it requires a great deal of practice. It is easier to get the result aimed at by means of a fine stipple, which only requires patience and care; but much of both virtues. The pigment must be very weak and the brush almost dry, so that it just leaves a mark when its extreme point touches the paper. If the colour runs, the brush is not merely too wet, but very much too wet.

In stippling with a brush the procedure is much the same as in pencil work. We start at the edges of the blemish and gradually extend the tone towards the centre ; not leaving a point until we have finished it, and the line of junction has vanished. If the brush is in the right condition for the work, each dot will dry almost as soon as it is made, but we must not run any risk of one dot running into another, and so every few moments it is well to make a pause to give time for what we have done to get quite dry.

The work is simplified if the blocking out of the patch on the negative is managed so that there is a vignetted outline to it, rather than a hard and clearly defined one. In some cases, too, it is possible to block out in such a way that the white patch on the print is bounded by the existing lines and masses of that part of the subject. It must of course be remembered, too, that the patch may not require to be filled in with an even tone, but with detail and gradation corresponding to that of the original piece missing. In such a case more skill in drawing is required, although with careful work there is perhaps less likelihood of the modification showing in the final result.

Another method of doing such an operation as we are considering is by the use of what is called "body-colour." Ordinary water-colours are more or less transparent, hence they necessitate getting in the first place a white patch on the print, which we proceed to tone down with pigment. Body-colour is pigment mixed with Chinese white and so made opaque. It is applied in sufficient quantity to hide what is underneath. If the patch is very black and has to be made quite light, it is best to block it out in the way just described, as to get sufficient opacity a good deal of body-colour would be needed, but if the degree of lightening required is not great, it can be done with body-colour. This is the method most often used by those who undertake such work professionally. It calls for more skill than either the pencil or the stipple plan.

Whatever means has been adopted, it has to be used until at a short distance there is no sign of what has been done. When this is the case, all that remains is to make a fresh negative from the enlargement, in the way described later on (Chapter XXIII), and then to make the prints from that. The reduction in size in doing this, and the fact that the whole of the image in any new prints will consist of the same photographic material, are helps towards concealing any work that may have been done, and, if all has gone well, it should be almost, if not quite, undetectable when the prints are closely examined. We can sometimes help to attain this end by introducing a slight diffusion in the prints, by printing through matt celluloid or some similar diffusing material.

It is surprising what can be done in this way by those who are willing to take the trouble, but it is not possible for the beginner to get a satisfactory result by slap-dash work. It must be done deliberately and carefully, and in a good light. When making the new negative, if pencil has been used, the subject must be illuminated from the front so as to avoid any glistening of the pencil marks when these are viewed from the position occupied by the lens, and in this operation, also, the greatest care must be taken to expose and develop correctly. If this is done, there will be little loss in the gradation of the photographic image, when the final result is compared with a direct print from the original negative; but some slight loss of quality seems inevitable in all copying operations.

CHAPTER XX

Making up a Developer

THE MATERIALS REQUIRED—A TEN PER CENT. SOLUTION—DISSOLVING METOL—KEEPING THE DEVELOPER—USING THE SAME DEVELOPER FOR BOTH NEGATIVES AND PRINTS.

MOST of the packets of gaslight and bromide paper on the market include in the instructions given with them a formula for a metol-hydrokinone developer, as this gives fine black tones and clean whites on such papers. The method of making up such a developer is very simple. The quantity of the materials which should be bought are one ounce each of metol and of hydrokinone ; a pound each of sodium sulphite and of sodium carbonate, both in the form known as " crystals," and an ounce of potassium bromide. Only a part of these will be needed at first ; but all the dry chemicals keep well if the bottles are well corked. It is cheaper to buy them in these quantities than in smaller lots.

It is best to make up the developer in the form of two separate solutions, as these keep better than if all were mixed together from the first. One which we will call " No. 1 " contains all but the carbonate, " No. 2 " being a plain solution of the carbonate. A couple of bottles with well-fitting corks will be needed, each holding a pint, and a third holding half a pint.

The stock bromide solution is made by putting the ounce of potassium bromide which was bought into the smaller bottle and adding to it cold water to measure nine and a quarter ounces altogether. The bromide very soon dissolves, and the bottle may be labelled " ten per cent. bromide." This means that every hundred parts, by weight, of the liquid contains ten parts by weight of the bromide. If in making up any formula whatever we find that bromide is required, all we have to do is to measure out some of this solution, taking ten minims of it, which may be taken as equal to ten grains by weight, for each grain of bromide specified in the formula.

The No. 1 solution is made up in one of the pint bottles. This should be well washed out, first with cold and finally with hot water, and while still hot forty grains of the metol are weighed out and put into it. About three-quarters of a pint of hot water is added, the cork is inserted, and the bottle given a shake. The cork should then be loosened to liberate the air, which the hot water has caused to expand, and soon, after another shake or two, the whole of the metol should have dissolved.

While it is dissolving we can weigh out a hundred and twenty grains of hydrokinone, or, which will be near enough, the ounce as bought may be divided into four equal parts, estimating these, and one of these parts taken. Three ounces of sodium sulphite can be weighed on the kitchen scales, putting a piece of clean paper in the pan to prevent contamination. After weighing the sulphite it should be wrapped up loosely in three or four thicknesses of paper and well rolled with a jar or strong bottle so as to crush it to a coarse powder, as it will then dissolve much more quickly.

The metol having dissolved, the hydrokinone may be added, and the liquid shaken from time to time, and when it also has all dissolved, but not before, the sulphite may be put in. The sulphite will soon dissolve in the still warm liquid, and the preparation of the solution is completed by adding two drams (120 minims) of the ten. per cent. solution of bromide, already prepared. The bulk of the liquid may then be brought up to one pint by the addition of cold water, and as soon as it is cold it will be ready for use.

Although not essential, it is sometimes advantageous to filter the solution through cotton wool, especially if it is to be used soon after making it up. For this purpose a tuft of absorbent cotton wool is wetted and pressed to the bottom of a glass funnel, the funnel is placed in the neck of a clean bottle, and the solution allowed to run through it into the bottle. A glass funnel is not essential, but a metal one must not be used. A piece of writing paper can be folded into a cone, the point cut off and the cotton wool pushed into it from the inside, and thus a funnel can be extemporized.

A clean one must be made for each purpose. The liquid which passes through should be water-white and clear. The bottle should be labelled " M.Q. Developer, No. 1."

Into another bottle, labelled " M.Q. Developer, No. 2," may be placed three ounces of sodium carbonate, and about three-quarters of a pint of warm water added. The carbonate will soon dissolve, and the bulk of the liquid may then be made up to one pint by the addition of cold water. It will be ready for use as soon as it is cold.

If the bottles are provided with good corks, these solutions will keep in working order for months, but it should not be forgotten that all photographic developers gradually deteriorate, so that a larger quantity than is likely to be used in a month or two should not be mixed up at once.

To make up the working solution for any of the standard brands of gaslight paper, we may take equal parts of No. 1 and No. 2 and mix them together. The solution can be used as it is, or we may add to it its own bulk of water. For gaslight papers more water than this should not be used ; but for bromide papers and for negatives it may be diluted further. For prints the mixed developer may be used over and over again, so long as the prints are seen to be of a good black colour ; but as soon as, on examining the fixed print in white light, there is seen to be any sign of a greenish tint in the image, it is an indication that fresh developer should be used. The mixed solution after use must be thrown away, and not kept over for another day.

Although the developer described here may not be exactly identical with that given in the makers' instructions with any particular paper, it will be found closely similar in its actual composition to many, and, as far as I am aware, it is suitable for any bromide or gaslight paper on the market. Owing to the necessity for buying more of the various chemicals than are wanted at once, the primary outlay will be a good deal more than for a bottle of some ready-made solution, but in the long run the home-made developer will be found to come a good deal cheaper. Even if it seems dearer, bulk for bulk, it will only be because it is stronger ; and when diluted down until as weak as the ready-made liquid, the saving will at once be apparent.

CHAPTER XXI

Sulphide Toning

A " FOOL-PROOF " PROCESS—THE IMPORTANCE OF THOROUGH FIXING AND WASHING—COMPOSITION OF THE BLEACHING BATH—THE SULPHIDING SOLUTION—POSSIBLE CAUSES OF FAILURE.

MANY photographers find the pure grey of a good untoned gaslight or bromide print answers all their requirements ; but there are others who appreciate the variety given by a sepia or brown tone, and these may like to know that, given a good black and white result, this colour is got very easily and very reliably by the process known as sulphide toning.

In the whole range of photographic operations there is probably none other which is quite so simple and " foolproof," as the phrase goes. Provided the solutions are correctly made up, and the original to be toned is a good one, it is hardly possible to go wrong. The process has two stages. In the first the print is bleached, and the action being allowed to go on until it is complete, it is not possible, within reason, to overdo it. Another solution is then applied, which darkens the image, restoring it once more to its full vigour, but giving it a brown instead of a black colour. This action, also, is allowed to go as far as it can : there is no risk of going too far. The washing out of the chemicals used and any by-products completes the toning.

The process is called sulphide toning because the original black image, which consists of metallic silver, is converted by it into an image of silver sulphide. Silver sulphide is a very stable compound, so that the toned image is at least as likely to be permanent as the untoned one. It is, if anything, more permanent. A properly fixed and washed bromide or gaslight print can be relied upon to be permanent under all reasonable conditions of keeping; but there is always the possibility of the fixing or washing not having been complete. Now the toning process is an absolute guarantee against this danger, for if the fixing were insufficient, the picture would be badly stained and ruined in the toning; while if the washing were not adequate, the toning would reduce the print and spoil it in that way. So that, if the toning process gives us a good result, we have the assurance that both fixing and washing were thorough.

The previous paragraph will have indicated the importance of thorough fixing and washing of a print that has to be toned: but there is another important point in this connection, and that is, that the original development of the print must have been complete. If it was not, then poor, weak, reddish-yellow tones will be the result. In describing the development of a gaslight print, it was pointed out that, if the exposure of the paper had been correct, the developing seemed to slow down and almost stop when the picture was fully out. and that this slowing down should be noted, and development allowed to go on for a little time after the picture appeared to have acquired its full strength. If for any reason this is not done, and the development is stopped at an earlier stage, we may get a result which will look well in its untoned condition, but it will not bear toning.

For the bleaching process there are a number of solutions, any one of which can be used. Slight differences in colour will result, according to the nature of the bleacher, but they will only be very slight, if the operation is properly done; and so the choice of bleacher may be governed by what chemicals the photographer has, or can get conveniently. Probably the most widely used bleaching bath is one which consists of a solution of potassium bromide and potassium ferricyanide. The exact strength of this bath is of no great importance.

A convenient stock solution is made up by putting into a bottle an ounce of each salt, and adding water to make a pint in all. One ounce of this can be diluted with three or four ounces of water, for use, and the diluted solution employed over and over again, as long as the visible action shows that the solution is not exhausted. The fixed and washed print is put in the bleaching bath, either wet, just as it comes from the last washing water, or dry. It is unimportant which it is. The image soon begins to weaken, but never altogether disappears; and, when it is evident that the bleaching has stopped, it may be rinsed, and the darkening solution applied.

Another very good bleacher is a solution of potassium bichromate acidified with a little hydrochloric acid. Two stock solutions are required which will keep in good working order indefinitely. The first is a five per cent. solution of potassium bichromate, which can be made up, near enough for all practical purposes, by dissolving half an ounce of the bichromate in water to make ten ounces. The other is merely dilute hydrochloric acid—one ounce of the strong acid mixed with four ounces of water. For each ounce of the bleaching bath required for use, we put into a measuring glass forty minims of the stock bichromate solution, sixty minims of the dilute acid, and add water to make up the ounce.

An objection which has been raised to the bichromate bleacher is that the bichromate stains the paper, unless it is properly washed out; but this washing is not a very troublesome one. The image in the bleaching bath nearly, but not quite, disappears. The print or enlargement should then be given four or five changes of water, making each change as complete as possible, so as to get rid of the surplus bichromate quickly. After four or five minutes spent in this way, only a faint yellowness will remain, and this will vanish in half an hour or so, if the paper is left soaking in clean water. The water may be changed once or twice to facilitate matters. The image is then ready for darkening again.

A third bleaching method may be mentioned, and that is one in which an acidified solution of permanganate is employed. A stock solution can be made up by dissolving twenty grains of potassium permanganate in half a pint of water, and a second stock solution is the dilute hydrochloric acid just described. The bleaching bath is made by mixing, for each ounce required, one dram of each solution, adding water to make one ounce. Very little stain is left by this bleacher, and three or four rinses will leave the print ready for darkening. If it should be at all stained, it is best to proceed with the darkening, and apply a clearing solution afterwards. The clearing solution recommended is made up by dissolving twenty grains of sodium sulphite in three or four ounces of water and adding thereto ninety minims of the dilute hydrochloric acid.

Just as there are several solutions which can be used for bleaching, so there are several available for darkening or sulphiding the image. They all have one quality in common, namely, a smell of rotten eggs (sulphuretted hydrogen). Sodium sulphide is the one which is most widely used. It is obtainable in the form of moist-looking clear crystals, sometimes slightly greenish, and should be made up into a stock solution forthwith, by adding enough water to an ounce of the crystals to make ten ounces in all. For use, one dram of this solution may be diluted with five ounces of water.

An alternative bath is made by diluting thirty minims of ammonium sulphide, a liquid, to make five ounces. A third sulphiding bath consists of ten grains of " liver of sulphur " dissolved in five ounces of water.

Whatever the sulphiding bath that is chosen, it is important not to use it any stronger than has just been specified. as all of these solutions have a powerful action upon gelatine, softening it so that it is very easily injured. The bleached picture is placed in the darkening solution, and almost immediately the image makes its appearance again, rapidly growing to its full strength, but brown in colour instead of black. As soon as it is evident that the action has gone as far as it can, there is nothing more to be done but to give the final washing to get rid of the chemicals employed for toning. This does not have to be of the thorough kind required to remove the hypo. Half a dozen complete changes of water, draining the print, and rinsing out the dish between each will be sufficient. The surface should be handled as little as possible, as the sulphide leaves it tender.

It has already been pointed out that if the original gaslight or bromide print was not developed fully, the image when toned would be of a poor colour. The only other causes which are likely to operate to produce such a result are

(1) attempting to tone a print from which the hypo had not been properly washed out after fixing, and (2) the use of a stale solution for sulphiding.

All sulphide solutions from the very time at which they are made up, begin to decompose. It is true that in the case of a strong solution of sodium sulphide, for instance, kept in a well-closed bottle, the change will be a very slow one, lasting perhaps many months. But it is going on, and one of its effects is to produce hypo, or some similar compound, in the solution. The result of this is that, although there may be enough of the sulphide present to cause the picture to darken, there is also enough hypo in the liquid to weaken the image, and so to cause the colour to suffer. For this reason it is best to use, as far as possible, a freshly prepared darkening bath. After use the diluted solution should be poured away. It may be followed down the waste-pipe by a little potassium permanganate solution, which takes away some of the smell.

CHAPTER XXII

Home Portraiture

Choice of a Background—Lighting the Sitter—The Pose—Lenses and Stops—The Exposure—Development—Retouching—Softening the Focus.

WHEN the novice makes his first attempt at a portrait and finds that the result does not come up to his expectations he often feels tempted to blame something unsuitable in his apparatus or his materials. He has read of a " portrait lens," and wonders if what he has got merits that description. Or he finds that there are such things as " portrait plates," while he has used some other kind. Failing that, he may put down his want of success to the absence of a proper studio, or to that favourite explanation of the non-photographer—" a poor light."

Let us remove these misconceptions at the start. Neither a portrait lens nor portrait plates, neither a studio nor a " good light," is needed to produce as fine portraits as have ever been made. Such things are conveniences merely, and need not affect the quality of the results. What was probably wrong was that the camera at the time that the exposure was made was not pointed at a subject which would make a good portrait—by which is meant, not a reflection on the sitter, but a criticism of the photographer's arrangement of the sitter.

Few realize until they have been at photography for some little time, how large a part in their success or failure is played by the operations that *precede* the actual exposure. Take the case we are considering. If the portrait is to be successful, we must not only study the pose of the sitter, but also the arrangement of the lighting, and the background or setting.

I have often had portraits sent to me for an explanation "why the face is so dark"; when the darkness of the face had nothing whatever to do with photography, nor even with the complexion of the sitter. The photographer had used as his background a brilliant expanse of sky against which the fairest skin, unless the sun actually shone upon it, would look dull and heavy. This is not always the cause of dark faces in portraiture. Even against a very dark background a face may look dull and heavy if the exposure has been too short.

The first thing to have attention, then, must be the choice of a background. In making this we must guard against selecting one that will "look nice." This is almost precisely what a background should not do. It is a portrait we are setting out to take, not a background partly obscured by a sitter; and we must therefore choose for the surroundings of the sitter something that will not attract attention to itself, either by looking nice or the reverse. We need for such a purpose something that will take a completely subordinate place.

Subordination in photography may be obtained in various ways. One plan is to have those parts that are to be subordinated slightly out of focus. This is not always possible, although it is generally more easily effected in the case of portraits than with most other subjects. Another way that is nearly always useful is to see to it that there are no strong contrasts in the parts to be subordinated.

In home portraiture a simple way of suppressing the background is to have it perfectly plain. It may be a large sheet of brown paper, or of fabric; but if we select as a backround some plain material—as, for instance, a sheet—we must not use it in such a way that folds or creases can be seen on it. This entirely negatives the merits of such a choice. We might just as well use the brick wall or ivy background, so often laughed at. The brown paper is chosen, not because our friend is to be shown in front of what is evidently a sheet of brown paper; but because, when it is properly used, it will give us just a plain tone. Creases and folds prevent this. If creases exist, and cannot be got rid of in any other way, then either the background should be shaken during the exposure, so as to blur them into invisibility or else it should thrown well out of focus. With the lens likely to be used by the amateur for home portrait work, it will be better to rely upon movement.

There is, of course, no reason why we should not make the portrait against a background of the room itself, provided we can keep it from becoming too prominent. If the wallpaper is plain, or has a very subdued pattern, it will do ; but the design on wallpaper is apt to be more staring in a photograph than it is to the eye. An open doorway into a room which is not too brightly illuminated makes a very good dark background. Indeed, a door itself is often an excellent setting for anything up to a full-length figure, especially if it is simple in its panelling and is enamelled white or cream. The door handle at once suggests a natural pose for the hand, as does the door itself for the figure.

When arranging an indoor portrait, it is a good plan to study the setting of the sitter carefully, eliminating everything that is not actually required for some specific object in the picture-making. Such things as ferns and flowers, pictures on the wall, startling lace table covers or chair covers, and so on, should be watched for and put outside the field of view. In taking portraits out of doors, the principle is the same, although it will be applied differently perhaps. In the garden one can often find an excellent background, in the shape of some tree or hedge which, in a certain light and not too sharply focussed, is quiet and unobtrusive. At another time, with the light in another direction, the same background may be full of strong contrasts and most unsuitable. A useful hint in this connection is to have the camera high. At waist level the head of the subject may come against the strong contrasts of the skyline ; whereas a couple of feet higher, or more, the skyline may be well out of the top of the picture.

In considering the important question of lighting in portrait work, it will be well to point out that the illumination must be regarded in its effect upon the play of light and shade upon the subject, and not merely, as some might suppose, from the point of view of the strength of the light.

Although in favourable conditions, out of doors in summer, portraits may be obtained by means of " snap " exposures, this is not always possible at other seasons, and for indoor work at any time of the year time exposures must be given. The camera being supported on a stand, it does not make any great difference whether we have to give one second or thirty, except in the case of children ; so that we need not make any great sacrifice of effect merely to cut down the exposure a little. It is well to use the largest stop in the lens, and the rapid plates which we use for hand camera work in general, of the particular make to which we are accustomed.

The actual exposures may be determined by meter ; but as in indoor portraiture in an ordinary room, not a studio, over-exposure is practically impossible, one may dispense with the meter, and give as long an exposure as the sitter can endure without moving. Under-exposure is as common in home portraiture as it is in hand camera work in general ; although there is really less excuse for it.

Supposing the portrait is to be made by daylight, in a room with one window, there are many different arrangements which may be adopted, any of which can give an effective portrait. The worst of all is one that is often seen, in which the sitter is put on one side of the window and close up to it, while the camera is on the opposite side. This position is chosen because of the belief that the light being strongest near the window, the exposures will be shortest. As a matter of fact, the shadows in that position are often the heaviest rather than the lightest, and it is the lighting of the shadows which has to govern the exposure. So that not only is the illumination with that arrangement at its worst ; but it does not even possess the advantage which led to it being chosen.

It is a good plan to start the preparations for an indoor head and shoulders portrait by covering the lower half of the window with some opaque material. Brown paper pinned up does as well as anything. The upper half may also be covered with thin muslin, to act as a diffuser to soften the light, but this is not a necessity. It is important from the exposure point of view to have the top part of the window as clear as possible from obstructions, since that is the quarter from which most of the light comes. If it has any blind fittings or draperies that cut off only an inch or two of its width, it will pay to remove them, if it can be done without much trouble.

The sitter may occupy a chair seven or eight feet from the window and a little to one side of it; while the camera may be placed as near to the wall in which is the window as will allow of easy access, and on the opposite side of the window to the sitter. The lens will therefore be directed in a line which makes an angle of 45° or a little more with the wall in which is the window. It must be understood that I am laying down hard and fast rules of this kind only to give the beginner an idea of one arrangement which will do well for his first attempts, and not suggesting that this is the only way, or even the best way. He will not be doing wrong by departing from these instructions, provided he does so with some definite end in view; but I advise him not to depart from them until he has at any rate made one successful portrait by working on these lines.

If the walls and general tone of the room are light, there will be no need to use a reflector of any kind, and it is well to do without this whenever possible. But if they are dark and the room is large, the exposure can be helped considerably by such means. A clothes-horse or similar support, with a sheet thrown over it, makes a good reflector. It must not be put too near the sitter, nor too far round from the camera. In fact, its best position is roughly parallel with the line of sight from lens to subject and about midway between them.

These arrangements made, it only remains to settle the pose. The sitter should be asked to take up such a position that that side of the face that is in the light is seen from the camera, and the shadow side partly turned away. The exact position will depend on the relative distances of window, camera, and sitter, and the effect of the lighting, and of slight movements of the camera and of the sitter's head, should be carefully noted. In this kind of portrait work the largest stop in the lens should always be used; the reason, of course, being that it is necessary to keep the exposure as short as possible, on account of the chance of movement on the part of the sitter.

There is another reason why it is well to use a large stop in portrait work. When we focus some fairly near object, as in the case of a portrait, using the largest stop in the lens, we find that more distant objects are no longer sharp. If we wish to make them sharp at the same time as the near object, we must try a smaller and then a smaller stop, until we see that we have what we want. This, as is well known, is the principal use of stops. There are many subjects with which it is important to have both near and distant objects equally sharp, but, within certain limits, this does not apply to portraits. It is often actually helpful to be able to have the image of the sitter himself sharp, while the background and the rest of the picture are diffused ; and this is obtained by using the largest opening in the lens and focussing carefully.

Those who have fixed-focus cameras can only secure a near object sharp, while using at the same time a large stop, by attaching a " portrait magnifier " to the front of the lens on the camera. The use of such a magnifier has been explained in the section dealing with focussing.

The lenses termed " portrait lenses," as already mentioned, are not at all necessary for portrait work. They work at a large aperture, generally about f/4, and so allow portraiture to be done indoors with comparatively short exposures. The actual difference, however, is not so very great. A lens at f/6 requires nine seconds exposure in the same circumstances as one at f/4 requires four seconds, but in all other respects, one is just as suitable for portrait work as the other.

There is one point in connection with the lens for portrait work which calls for mention, and that is its focal length in comparison with the size of the picture. Most cameras with lenses ready fitted to them are provided with a lens the focus of which is very little (if any) longer than the longer side of the picture. For many classes of subject this is the most generally convenient, but for portraits it is decidedly too short. It would be much better were the focus double the length of the longer side ; many prefer it three times, or even more.

The reason for this is that the longer the focus, the farther may be the camera from the sitter, and the narrower is the angle of view included. The distortion which is often seen in portraits, where the sitter's hand may seem to be almost as large as his head, for example, is due to a lens of too short focus. Hence some photographers who have lenses that allow one half of the glasses to be unscrewed, leaving the other half a workable lens of longer focus, often use such a half lens for portraiture. But as the effect of unscrewing half the lens is to alter the f/- numbers of the stops—f/8 being then f/12 or f/14 perhaps, in actual value, and so requiring, it may be, three times the exposure which would be necessary were the whole lens to be used—it is often thought that it is better to use the complete lens and put up with any distortion that its comparatively short focus may involve.

There is, however, a much better course open. The mere fact that the camera will take a plate of a certain size is no reason why that size should always be used. The owner of a half-plate camera may fit up a simple screen in front of the dark slide enabling him to take two separate portraits, side by side, on the half-plate, or he may get carriers to take quarter-plates in his dark slides, and use these for portrait work. He will thus be able to use the complete lens, and enjoy its full rapidity, while at the same time he will be using a lens nearly twice the focus of the longer side of his picture. The user of a small camera, who cannot adopt one or other of these expedients, should get the head and shoulders portrait in the middle of the plate, and then trim down the print, or only print or enlarge from the middle of the negative, and, in this way, he can obtain a similar result.

The rule, in any case, should be to have the camera as far from the sitter as can reasonably be arranged, even if this means that only half the plate or less is used for the picture. If this rule is followed, there will be little sign of the distortion due to the use of a lens of too short a focus. It is not the actual focus of the lens, but the distance of the lens from the subject that matters.

The exposure may be as long as the sitter can maintain his position without serious movement. Very slight movement, during a long exposure, is sometimes actually an advantage. It may be too slight to introduce any perceptible blurring, and yet enough to soften the image sufficiently to hide any of the trifling blemishes that necessitate retouching. Blinking of the eyelids, for example, does no harm.

In developing portraits, one must be very careful not to carry the development too far. Compared with a negative of a landscape, a good portrait negative should look distinctly thin. Full exposure and moderate development should be the rule.

An examination of examples of studio portraiture may lead the beginner to suppose that he will be compelled to resort to the elaborate retouching often practised by the professional. Now, retouching is one of the most unsatisfactory subjects with which a writer can deal, because only a very small proportion of it can be described in words at all. So much depends upon knack, upon practice, and still more upon a natural aptitude with the pencil. Unless the would-be retoucher possesses this last quality he will do better to omit retouching altogether, or else put out the work. The legitimate purpose of retouching is to prevent any exaggeration of skin blemishes, etc., which the photograph may have made, and to remedy trifling defects in the negative. The latter is more correctly described as spotting. Anything beyond these is a mistake. To please some sitter we may have to produce a print with all the facial irregularities taken out, and the whole smoothed down to the texture of a billiard ball, while everything is at the same time critically sharp ; but if so, it is better to call in the help of the professional.

There are one or two points to be mentioned in this connection. One is that the blemishes which photography may undoubtedly exaggerate are slight differences in the colour of the skin. Spots that are only a little more yellow than the rest may come out startlingly distinct if photographed on an ordinary as distinct from an orthochromatic plate. The use of an orthochromatic plate, preferably with a colour screen if the exposure allows, will do much to obviate the necessity for retouching ; and in this respect the self-screen plates now popular with many amateurs are very useful. Under-exposure greatly accentuates such blemishes, and much of the desire to be able to retouch originates in the appearance of some of these under-exposed portrait negatives. If this defect is avoided—as it should be, for other reasons as well as this—one great step will have been taken towards emancipation from any necessity for retouching.

But that is not the only thing which can be done. On a small plate, such as is generally used by the beginner, any skin blemishes can only be of the minutest character, and it is possible to mask them altogether by not having the image critically sharp. There is no need for microscopic sharpness in portraiture at any time, and any softening of the definition, if not carried too far, is an actual improvement. Anyone who notices the principal portraits in the photographic exhibitions cannot fail to observe that it is seldom indeed that they are absolutely sharp anywhere.

This softening effect is often produced by the use of special lenses which are incapable of yielding fine definition, but for the limited purpose now under consideration there is no need to get a special lens. Nor do I advise the photographer to put his image out of focus. It will be well if the beginner makes his negative as sharp as the lens—working at full aperture, of course—will give it, and then, starting with this as a basis, he can get sharp or diffused prints at will.

To do this, he can print on paper of a more or less rough surface. This does not make the results unsharp, in the strict sense of the phrase ; but while the parts of the image on the summits of the little hillocks on the paper are as sharp as ever, the image in the intervening valleys is diffused, and the finer details of the picture are lost.

Another plan, and a most effective one, is to make the print on a comparatively smooth paper, such as platino-matt, interposing something between the negative and the paper during printing, to prevent them from coming into perfect contact. There is nothing better then sheet celluloid for the purpose ; and a few old film negatives, from which all trace of gelatine has been removed, may be kept clean in a box, and used as required. The number of such pieces to be interposed will depend upon the degree of softening that is desired. It is an interesting and useful experiment to make a set of prints from the same negative, starting with one in which the paper was in contact with the negative, and going on with others in which 1, 2, 3, and so on films have been interposed. A piece of bolting silk or fine tracing paper may be put on the negative, and then one or more films ; or matt celluloid of different thicknesses, can be used for the same purpose. Large negatives will stand much more in this way ; even glass can be interposed with advantage at times.

The full effect of these devices is only obtained if the light by which the printing is done comes from a diffused source. In daylight printing on p.o.p. and similar papers, there will be no trouble at all, provided, of course, that the printing is being done in diffused light and not in direct sunshine. The light creeps round in the thickness of the celluloid under the image, and so every detail has a slightly softened outline. With contact printing on gaslight and bromide paper, however, it is usual to employ a more concentrated and direct light source, such as an electric light or incandescent gas ; and it is necessary in that case to interpose between the light and the printing frame a diffuser of some kind. A sheet of tissue paper or of ground glass will do very well. If this is not done, a greater thickness of celluloid may be required to bring about the same degree of diffusion, and the action is irregular. The same result may be got by keeping the printing frame or the light moving about during exposure ; but the use of some diffusing screen is preferable. The celluloid entails a longer exposure, but this can be allowed for.

However it may be brought about, the result should be to do away with all necessity for retouching. Of course, if the sitter wishes to have modifications introduced into his physiognomy, or if it is necessary to give him an appearance that he does not possess in actual life, it is another matter.

CHAPTER XXIII

Copying

WORKING ON A LARGER SCALE—THE USE OF A MAGNIFIER—LIGHTING THE SUBJECT—CAMERA EXTENSION AND STOP VALUES—EXPOSURE—PARALLELISM—THE STOP TO USE.

SOONER or later almost every amateur photographer finds himself confronted with the task of making a copy of another photograph, and if all his experience up to that point has been snapshot work, it seems of very little use to him. It is not a particularly difficult operation, but it is an unfamiliar one.

For many beginners, their initial attempt at making a copy will also be the first time they have tried to photograph on a large scale. When we snapshot a tree or a house, the dimensions of the picture compared with those of the original are perhaps 1 : 200. When we take a full-length figure they may be 1 : 20 : but, in copying, we may wish the copy to be on the same scale as the original, or, at any rate, on a much larger scale than 1 : 20. The original, therefore, must be much nearer than we should have a sitter or a landscape. If we know the focus of the lens we can tell in a moment how far from it, approximately, to put our subject. There is a little rule which may well be committed to memory for our guidance in such cases. It is that the distance of the subject from the lens is the focus of the lens multiplied by one more than the ratio. The ratio is the ratio of any linear dimension in the original to the same dimension in the copy. (If the focus of the lens is not known, we may assume, with sufficient accuracy for our present purpose, that it is the distance between the stop and the plate or film when a distant object is in focus.)

For instance, if we have a picture the bottom of which is six inches long, and we wish to photograph it so that in our photograph that bottom line is three inches long, the ratio is two. If the six inches in the original were to be only two inches in the copy the ratio would be three, and so on. So that to get the bottom line three inches long, since the ratio is then 2, and the rule tells us to add one to this, we know that the subject must be three times the focus of the lens from the lens. If the lens is one of four and a half inches focus, then the picture must be thirteen and a half inches from it.

While this rule is absolutely true, we cannot use it in practice more than as a rough guide, because, in most cases, we only know very approximately the focus of the lens in use, and also because we do not usually know the precise point on the lens from which to make the measurement. But it is useful, all the same, as giving us a rough idea of where to put the original. (In copying same size it is easy to remember that the subject must be twice the focus of the lens from it ; since the ratio is 1, and adding 1 to it gives us 2 as the figure by which to multiply the focus.)

Setting up the original as near the camera as this, a difficulty at once arises if the camera is one of fixed focus or has very limited extension. We have already seen that the nearer an object is to the camera the further the lens must be racked out to bring it into focus ; or, on the other hand, if it is a fixed-focus camera, and we cannot rack out the lens, we cannot focus near objects at all. A subject only a foot or less from the lens would be hopelessly blurred.

If the camera has " double extension " there is no difficulty. We merely rack out the lens, taking care is so doing to keep the original at about the distance required by the rule we have just given, until the picture on the focussing screen is sharp. If the camera extension is very limited, it may be possible with a little ingenuity to construct an extension piece of card or wood, which can be fitted on, when we have such a job as this, and will carry the lens at double, or nearly double, its usual distance from the back. An alternative is to fit the lens with a " copying magnifier." This can be bought in a little fitting to carry it close in front of the camera lens. When it is in place, the more distant objects will be blurred in the negative, but a sharp image will be obtained of any subject that is only a few inches away.

The next thing to decide is the light by which to make the exposure. As the subject cannot move there is no reason to avoid a long exposure, so that we can use either day or artificial light, whichever is the more convenient. If daylight, exposure may not exceed a few seconds ; but with most forms of artificial light it will run to minutes. Instantaneous shutter exposures are out of the question in copying.

The lighting must be carefully arranged if we are to get a good copy. The surface of a picture on paper is not absolutely flat, even if the paper itself seems quite smooth. Under a magnifying glass it is seen to consist of little hills and valleys. If the light falls on the original right from one side, it catches these little hills and throws shadows into the valleys. To avoid this the lighting must be arranged so as to fall as nearly as possible vertically upon the paper. In other words, the light must come from somewhere about the direction in which the camera itself is placed, or, if not, at any rate the lighting must be of a general or scattered character.

In copying in daylight out of doors an even general illumination is best secured by arranging the subject to face an expanse of sky, preferably tilting it slightly upwards. If the work is done indoors the subject should face the window, even if it has to be a good way into the room to allow the camera and the operator to get between it and the window. We must see that no shadow falls on the subject.

If artificial light is to be used, say, a lamp, for instance, it should be as nearly in the line between the lens and the subject as we can get it, without actually getting in the way. Moreover, if we have only one lamp, it should be on one side of the lens for half the exposure and moved to the other side for the other half, as this is a great help towards even illumination. With the lamp in this position, unless we take some steps to prevent it, light from the lamp will fall directly upon the lens. This would be fatal to any successful result. Either we can fix up a screen of some kind to protect the lens from such direct rays, or, which comes to the same thing, we can furnish the lens with an extended hood to cut off all but its view of the subject itself. A sheet of card may do what we want, or a stick or sticks can be fastened to the top of the camera, projecting over the lens, and the focussing cloth can thus be supported to form a tunnel or shield for the purpose.

A common mistake in work of this kind is incorrect exposure. We no longer have to consider the light and shade afforded by the relief or solidity of our subject, such as confronts us in landscape or figure work. The original which we are copying is, comparatively speaking, a flat surface, every part of which is receiving just as much light as every other part. The result of this is that the scale of light and shade is much less than in most of the subjects which we photograph, the darkest part of the original being much less dark than a shadow in a solid object may be. Expose for the shadows is the sound rule in all photography ; and it is as true in copying as in any other branch, except that the shadows here, which are not real shadows, but only dark colourations on a flat surface, are not very heavy in any case.

On the other hand, if we are working with a camera very near the subject, as we invariably must do in copying, the camera extension is increased. In copying same size, we have seen that it is necessary to have the lens twice its focus from the plate to get a sharp picture. When we are not copying upon so large a scale as same size, the racking out necessary is less ; but still, in copying work, the camera extension is a good deal more than is needed in the case of portraiture, which itself needs more, in a general way, than does landscape.

The effect of racking out the lens is to increase, for the time being, the f/- number of the stop, and therefore to increase the exposure required. It has been explained that the f/- number is the number of times the diameter of the stop opening is contained in the focus. Thus f/8 with a five inch lens means that the stop is one-eighth of five inches ($\frac{5}{8}$ inch) in diameter. If to photograph an object the same size as the original we have to rack out the camera until with such a lens the extension is no longer five inches, but ten inches, the size of the stop remaining unaltered, then it is evident that, as far as such work is concerned, the stop is no longer f/8, but f/16 ; because $\frac{5}{8}$ inch, which is the diameter of the opening, is contained sixteen times in ten inches, while only eight times in five inches. The exposure given with the stop marked f/8, therefore, will not be the exposure indicated for f/8, but that indicated for f/16. In other words, it will be four times as long.

There is one way by which all these complications can be dodged, and that is by making all the arrangements for copying and then exposing a plate in a series of strips by pushing in the shutter of the dark slide from time to time, developing this plate, and giving on a second plate the exposure which the trial has shown to be correct. This is only practicable when the camera is fitted with a dark slide, and when development can be done at once ; but when the work is done under these conditions, it is much the best plan to follow.

In developing the copy, the appearances are not the same as those to which we are accustomed in landscape and figure work. The shadows being much less heavy, the image soon after it comes up begins to darken over, and long before development is complete, if the exposure has been full enough, the whole surface of the plate will become quite dark, and unless the light in the dark room is very bright no image will be visible upon the surface of the negative as it lies in the dish. The consequence is that one is tempted to under-develop, and so to get a negative which will only give a weak print. It is important, therefore, to develop fully, and not to be misled into thinking that, because the surface has darkened all over, therefore, the development is complete. Of course, the unexposed edges of the plate or film where is it protected from light during exposure should remain light until development is complete, but all the rest may be black without any fear of injury to the result.

Before leaving this topic, there are a few minor matters to which it is well to draw attention. One is that the camera is better not supported on the tripod when copying, as it is awkward to have to level it every time its distance from the object is varied. The best plan is to set up the camera and the original on the same table, so that any slight vibration of the floor during the long exposure will not give rise to any blurring of the image, as it might if they were separately supported. All the same, one should avoid walking about during the exposure more than is absolutely necessary.

As the original has, presumably, straight edges and right-angled corners, we must be careful in setting up the apparatus to do so with the subject and the plate exactly parallel to one another. If this is not seen to, the image will not be square. Focussing also is affected by any want of parallelism, so much so that it forms a very good test. If on focussing with a large aperture we find that all four corners of the picture come sharp simultaneously, we may be pretty sure that the original and the ground-glass are parallel.

Then there is the character of the original to be considered. A drawing in black on white requires an exposure full enough to give great density in the negative, which should be fully developed for the purpose. A cold-toned photograph (such as a bromide) requires less exposure than a warm-toned one (such as one on self-toning paper). If the paper is yellowish, an orthochromatic plate and a yellow filter should be used. An original in colours may need a panchromatic plate and an appropriate filter; but probably the beginner will be concerned only with the copying of monochrome subjects such as photographs. Should the photographic image itself have faded to a yellowish tone, an ordinary plate should be used, as this will give a stronger image in the copy.

It is often asked what stop should be used in copying. Unless a smaller stop is necessary for some specific purpose, the largest that will give the required definition should always be used. In copying, it will be found that a needlessly small stop makes it difficult to get a bright distinct copy. With a good anastigmat lens it should not at any time in such work be necessary to stop it down at all, or at any rate to use a smaller aperture than, say, the stop that is marked f/8; and with a rapid rectilinear or other cheaper instrument probably f/16 will give as good definition as anything smaller. When a copying magnifier is used a smaller stop may be necessary to get the best definition.

If the work is carefully done on the lines here laid down, it should be found to present no difficulties which a little thought and patience cannot overcome. If all has gone well, the copy should not be perceptibly inferior to the original.

CHAPTER XXIV

Landscapes

A TRIPOD A NECESSITY—CONSTRUCTING A FULL-SIZE FINDER—MAKING THE EXPOSURE—SELECTING THE SUBJECT—PANORAMAS—TIPPING THE CAMERA—EXPOSURES.

LANDSCAPE work, if it is to be worth doing at all, requires the camera to be used on a stand of some kind. Quite a cheap form of tripod will do, but the compact metal tripods are too short to be convenient. There are occasions when the camera is best used near the ground; but in most cases it is required at eye level, or as near this as the tripod will allow. A rigid tripod is always preferable; but with due care in exposing, provided the weather is not very windy, one can make shift with a stand which leaves much to be desired in rigidity.

The next consideration in landscape work is a full-sized finder. The picture has to be carefully arranged, and this cannot be done in the very small finders usually found on hand cameras. If the camera is of the hand-or-stand type, with a ground-glass focussing screen, nothing more than this could be desired on which to arrange and focus the subject; but if it is a box-form instrument, or one that does not allow of the use of a ground-glass, it is not a difficult matter to fit a finder which will show the image at its full size, and so be helpful.

To construct such a finder we have to bear in mind this fact, which anyone can confirm for himself by trial. If we could turn the camera round, so that its lens pointed away from the subject, and could remove the plate or film, and the glasses of the lens, and then could place the eye at the stop of the lens, which, for this purpose, need be nothing more than a mere pinhole, we should see surrounded or framed by the edges of the opening previously occupied by the plate or film, just that amount of the subject which, were the camera reversed again, we should get in our picture.

Therefore, if we can make a frame with an opening the size of the plate or film, and fix up a small flat piece of metal with a little hole in it to look through, we can arrange these on the top of the camera, so that on closing one eye and looking through the hole with the other eye, we see exactly the view which the lens will then give. The frame suggested should be fixed to the front of the camera, so that it comes immediately above the stop in the lens. With a box-form instrument, it is generally a very simple matter to do this, so that the frame can be detached when it is not required. It must, of course, be parallel with the back or front of the camera. It is sometimes convenient to add cross wires to the frame, so that the centre of the opening can be recognized at a glance.

The next thing to do is to make a small hole in a strip of metal, so that this can be attached to the top of the camera immediately over the plate or film. This strip must be long enough to allow the hole to be in such a position that on looking through it at the centre of the frame, as indicated by the cross wires, we are looking at exactly that part of the subject that will fall in the centre of the picture on the plate when we expose. In some types of camera, we can find what this object is, by opening the back of the camera and putting a piece of ground-glass where the film comes, and noting what part of the picture is central. In others, this is not practicable, but we can take what is seen to be central in the small finder as a guide, and then a single trial carefully carried out will show whether the bigger finder has been correctly fixed.

Such a finder will not be correct for objects only two or three feet from the camera ; but for any subject that can be called a landscape at all it will be as exact, if properly adjusted to start with, as can be wished. What we see within the boundaries of the frame, when we look through the eye hole, is what will be included in the picture when we expose.

The only other fitting necessary to make our hand camera suitable for landscape work may be a cap for the lens or some means of giving time exposures. If the shutter is one which can be set to " B " or " T," and has a pneumatic or Antinous release, we have all that is needed. But a shutter is unsuitable for time exposures if we actually have to press a button or release on the camera itself, as such pressure, as has been already mentioned, will shake the camera and blur the image.

It is best to provide the lens with a cap, if it has not one already, so that exposures may be made by hand. A ring of card can be attached to the front of the camera if the lens has not a hood, and a cardboard cap made to fit it easily, so as to come off without a jerk, but not to drop off. The inside of the cap and ring should be painted with some dead black varnish.

When such a cap has to be fitted, it is well at the same time to provide some fitting to take a colour screen between the cap and the lens, as for landscape work orthochromatic plates and a colour screen are often advantageous. The colour screen should be bought first and the fitting made to take it; so that it can either be dropped in before the cap is put on or slid in behind it. The colour screen not only gives us a better rendering of the different shades of green and helps to retain the clouds, if there are any, but it also prolongs the exposure, and so helps to bring it within the limits that can be correctly timed by hand.

One of the first lessons to learn in dealing with landscape is that wide expanses of country—what are called " panoramas "—do not in themselves make satisfactory photographs. The details that the eye can see, and the general air of openness and of extent, do not record themselves in our pictures at all. To obtain in the print what the eye can distinguish in a distant building, or group of trees, would require a lens of very long focus, such as the average amateur would not be in the least likely to possess, and it would also call for expert knowledge in the use of special materials—colour screens and panchromatic plates. When obtained, the photograph would then not embrace the panorama that we saw, but only just that small portion of it on which the lens was turned; and even that would not have a very natural perspective rendering. If a panoramic view is to be included in the picture at all, we must use it as a mere setting or background for the real subject, and be content to let the actual details of the panorama appear slightly, merely blending into a suggestion of open country. The interest in a landscape photograph must be essentially a foreground interest, or, at most, must lie in the middle distance.

In selecting a viewpoint, one is not under the necessity of having the camera level as in architectural work. We may tip it up or down just as may seem necessary to get the best effect. We may open out the tripod also or slide in the legs, or even fold them so that the camera " kneels," if a low viewpoint seems needed ; and, on the other hand, we may have the camera as high as it will go. With practice, the photographer will get to know which position will give the best effect ; but at first it is best to try them all and to study carefully on the ground-glass, or in the finder, the precise result of each movement.

When the subject has been selected there will be the final focussing to be done. Although much has been written on " differential focussing "—getting the subject itself sharply defined and the rest in soft focus—this is hardly work for the beginner, at any rate if he has only a small camera. One can do a good deal with a half-plate stand camera in this direction ; but in quarter-plate and smaller, we are using lenses which have much depth of focus, and we shall find with them that it is difficult and, indeed, often impossible to differentiate in focussing. All we need do is to make sure that the foreground, wherein lies our subject, is as sharply focussed as we can get it, remembering that a little softening of the definition of the extreme distance will usually go unnoticed.

The exposure must be determined by means of an exposure meter. In using the meter the only factor to decide is the character of the subject. In the majority of landscapes the subject falls in the " heavy foreground " class ; and if there is any doubt at all whether it is an " open landscape " or one with a " heavy foreground " it is better to give the latter the benefit. This follows from the fact that the exposures indicated by the meter are *minimum* correct exposures ; and that, if it has been used properly, we can always give twice the meter reading, and, in most cases, even four or eight times the reading without any fear of over-exposure, as has already been explained in Chapter XIII. It is possible that a novice with one of the cheaper forms of hand camera, when he passes to landscape work, will, for the first time, make the acquaintance of plates or films which have been properly —and not under—exposed.

Using the largest stop or the largest but one, it may sometimes happen that the exposure indicated by the meter is not short enough for the shutter to be used, but is too short for a correct exposure to be given by hand. An eighth of a second, or even a quarter of a second, is not easily timed by hand ; and unless the shutter has pneumatic regulation, and a good form of that, which most of the cheaper forms have not, such slow automatic exposures cannot be given.

An easy way out, with small cameras, is to stop down the lens until the opening is so small that the exposure is a second or more. There is no difficulty at all in timing a second. A half-second may be taken as the time required to count " One, two," while a quarter of a second is represented by the minimum time in which we can take off the cap right clear of the lens and replace it.

CHAPTER XXV

Indoor Subjects

STILL-LIFE PHOTOGRAPHY—TIME EXPOSURES NECESSARY—CHOICE OF A BACKGROUND—CONTROLLING THE ILLUMINATION OF THE SUBJECT—EXPOSURE AND DEVELOPER—TABLE-TOP PHOTOGRAPHY.

ALTHOUGH there is no good reason why the end of the summer should also bring outdoor photography to an end for the time being, there is no doubt that a great many—probably the majority of—amateurs look upon the winter as not the season for taking their cameras into the open. This is no excuse for dropping negative making ; there is plenty to be found at home which will provide effective subjects. For instance, still-life will give us good practice, and can be made to yield attractive pictures. Then we have arrangements of inanimate objects—china and glass, casts, coins, curios, entire rooms, pieces of furniture, antiques, and many other things the actual nature of which will depend upon the circumstances of the individual worker.

Such work cannot be done with a camera held in the hand and a shutter exposure. The camera must be supported on a stand of some kind, and the exposure will run to seconds, possibly even to minutes. A stand camera so-called is the most convenient form of apparatus, but any hand camera, however simple its construction and adjustments may be, can soon be arranged to do what is required.

Much of the success in this work, as in portraiture, will depend upon the background. If we simply set up the subject—a vase of flowers, or whatever it may be—and make the exposure regardless of what is behind it, we shall find either that such other objects as are included are sharp and distinct, possibly more distinct and assertive than what we intended should be the subject, or else they may be blurred to such an extent that one immediately wonders what it is the blurs are intended to represent.

We can get over both troubles by setting up behind our subject some suitable plain background, the tone of which must be carefully considered. Its colour does not matter in the least, but its tone when photographed—that is to say, the lightness or darkness of the shade of grey which it gives as compared with the greys of the subject itself—will be important. If the outline or profile of the subject is to be accentuated, then we must choose a background that will make a strong contrast with it—a light background for a dark subject or a dark background for a light one. If the outline would be better subdued, then we should have a background of much the same tone as the object.

For small subjects, cardboard or art mounting paper makes a very suitable background. The paper, if not perfectly free from folds or creases, should be stuck down on card, as it is important to have nothing but an even tone. White cardboard is best for some subjects; for others a perfectly black background is helpful. This can be made by giving the card a coat of dead-black varnish, or by using a piece of black velvet stretched smooth.

There is then the support of the subject to be considered. We may use a long strip of paper or card to act both as background and " floor," bending it round for the purpose, but it is usually more satisfactory to have two separate pieces, so as to get a horizontal line across the picture, where the " floor " and the " wall " meet. We must be careful not to have a gap there, which will show as a dark line, as this will look unnatural. A good way of arranging a small subject is to place it on a card that must be big enough to extend some distance behind it, and must terminate in a clean, straight edge. The background is separately supported an inch or two behind this edge, and is carried down below it, so that the bottom edge of the background is not seen at all from the position of the lens.

The next consideration will be lighting of the subject. It is presumed that it is one that will not move, so that mere intensity of light does not matter at all; if the light is poor, all that we have to do is to increase the length of exposure. If we set up the subject near the window and on one side of it, with the camera on the other, we shall get a strong side lighting with heavy shadows. This may suit our subject. A plaster cast in low relief, for example, will look more real and solid in such an illumination than it will with the light falling flat upon it. But for many things this is too harsh. It can be modified by moving the subject farther and farther into the room away from the window, and turning the camera round without otherwise moving it. In this way we can change the lighting from side light, through every intermediate position, until finally it is a direct front lighting. Which to select must depend upon the effect required, the point is that the result of different lightings must be realized, and lighting not merely looked at from the point of view of getting a strong illumination. The shadow side may be helped by setting up a sheet of white card to serve as a reflector, exactly as in the case of indoor portraits.

A special kind of indoor work has come to be known as " table-top photography," and the ingenuity of some of those who practise it has led to the production of many interesting and striking results. Some are merely quaint or mildly humorous, while others are of distinct pictorial merit. All sorts of things are pressed into service—dolls' house furniture, pieces of coal or stone for rocks, mirrors for water, salt for snow, shrubs for trees, and so on. Appropriate skies and backgrounds are drawn and painted, and models of animals and figures are employed.

The limit to such subjects is set only by the resourcefulness and ingenuity of the photographer, and although the work may be regarded merely as a pastime, it can provide some useful lessons and practice.

CHAPTER XXVI

Holiday Photography

DEVELOPMENT AWAY FROM HOME—CHANGING PLATES AND FILMS—REPACKING PLATES—THE USES OF A REHEARSAL—SOME HOLIDAY SUBJECTS—STREET SCENES.

MANY a camera is bought for the express purpose of securing some record of a holiday, and even if this is not the primary object of getting it, the thought of holiday work is at least a secondary motive. Whichever may be the case, there is one thing about which there can be no doubt, and that is that there ought to be some little practice at home before taking it away. The circumstances of work on tour are not likely to be so different that experience gained at home will not be constantly useful.

It is not a good plan to develop while away from home. Not only does the development of the negatives provide an entertaining task on getting back, it is not likely to be done so carefully or so well in strange surroundings; and while away one is generally fully occupied with other amusements. If one or two exposures are developed, this should only be to make sure that everything is in working order, and that exposures are correct. It is really best in such a case to make one or two duplicate exposures for this express purpose. They can then be developed, but they need not even be fixed, unless the photographer thinks he cannot judge from them in an unfixed condition. Having told their story they can be thrown away. This is much better than encumbering oneself with a complete developing outfit and bothering with washing the negatives in a hotel or other temporary quarters. Alternatively, they can be handed over to a professional or dealer to do the needful.

An exposure meter should be looked upon as a necessity for home work, still more so for work away from home, when one may be doubtful about the conditions. It is often said that the light is very much more powerful at the seaside, and that exposures can, in consequence, be cut down. Such a statement is only partly true. The direct light from the sky is no more powerful at the seaside than it is in any place inland where the atmosphere is not contaminated with coal smoke ; but the sea itself and the sandy shore act as reflectors, and so in a great many of the subjects which one is likely to get, the shadows are more powerfully illuminated than we are accustomed to find them elsewhere, and exposures are shortened in consequence. One result of this is that groups and similar subjects can be snapshotted successfully, even with a single lens and a shutter with only one speed.

What to take in the way of apparatus and material will depend on the nature of the work to be done. An elaborate outfit was thought essential not so very many years ago, but the modern worker is apt to run to the opposite extreme. He puts the camera in his pocket, and for everything else is content to trust to luck. An intermediate course is the best. It is wise to take a supply of plates, since their varieties are so many that it is possible that the particular make which the photographer uses does not happen to be stocked ; with roll film or film packs the need is not so great.

As far as plate changing is concerned, it is better also not to trust to finding a dark room available. Some of the dark rooms provided are far from being what one would choose for plate changing. In my own case, and I have exposed some thousands of plates away from home, I have rarely used any room for plate changing except my bedroom, and nearly always have done it without any red light. On a summer's night, with the blinds up, when so-called " darkness " has set in, there is generally plenty of light for plate changing, and yet not enough to do any harm. After one has been in it for a few minutes to get accustomed to it, a plate can be seen plainly enough ; but I have never found the slightest trace of light fog in consequence.

Every photographer ought to be able to load and unload his camera without having to use his eyesight ; but if he cannot, a dark room is easily extemporized. So long as one keeps to the towns, there is generally electric light in the bedroom. The fitting can be wrapped round with a couple of thicknesses of ruby fabric fastened on with a piece of string or with a rubber band. Alternatively, a little fabric lantern containing a lamp-holder, and fitted with a couple of yards of flexible wire and an adapter, can be used. The electric bulb is taken out of its fitting and placed in the lantern, and the flexible wire coupled up. In other places, one can use a folding lantern and a piece of candle ; but, as already said, it is much better to be able to do without a light altogether.

Roll-film and film packs give no trouble in the matter of repacking exposures, but plates are a little different. It is not really difficult to repack plates exactly as the maker sent them out, using the cardboard separators which he used. But this requires patience. A common plan is to put the exposed plates face to face, in pairs, with nothing at all between their films, and then to wrap them up in fours or sixes in the original wrappings. This course is open to the objection that the slightest particle of grit between the sensitive surfaces will give rise to a scratch on one or both ; and, however careful one may be, there is no doubt that this plan is not very reliable, although it can be adopted in default of anything better.

Some time before the war there were on sale little cardboard frames, known as Wheeler's Separators. They were, externally, the size of the plates, being about an eighth of an inch wide all round. I have heard nothing of them recently, and having still an ample supply, I have had no occasion to replenish my stock ; but they were much the best things I know for repacking exposed plates. One was put between each pair, and they kept the films from touching, while they were easier to adjust than the thin card strips used by the plate makers.

Whatever method of packing may be adopted, the packets should be tightly wrapped, so as to prevent all chance of the plates sliding on each other. They are then replaced in the boxes, and these are wrapped up and stuck down. It is important to stick them down, or some curious person may open the box to see what it contains. There need be no fear of the images on exposed plates in contact setting off on each other: this cannot possibly happen. But if an odd number of plates are to be packed, it will not do to let the film side of one of them come into contact either with the glass side of another or with the packing paper. The odd plate must be given a separator to itself, and be put with its coated side next the glass side of one of the pairs.

So packed, exposed plates will keep in good condition for many months before development. It is important, however, to use no paper inside the boxes, except that which the maker has used. This has been chosen because it is inert. I have known a sample of ordinary brown paper completely spoil the plates which were wrapped in it, although it never came into contact with their sensitive surfaces; and I have seen printing set off on to an undeveloped plate through the glass of the plate itself. Hence the importance of using inside the boxes no paper that cannot be relied on; outside the boxes any paper may be regarded as harmless.

If I were asked what is the mistake which is most frequently made in holiday photography, I should reply without hesitation—it is making a new departure at such a time. Getting a new camera, taking some strange brand of plates, adopting some fresh line of work, for the first time on precisely that occasion when there is the least chance of being able to repeat the exposures should anything go wrong. By all means let the equipment be as complete as we can manage it, but have at least one full-dress rehearsal before taking it away.

One of the most frequent of holiday subjects is a group; and as it may embody all those whose company has made the time pass pleasantly, its claim as a memento is a strong one. When circumstances will permit, it is well to have the group arranged with some other pretext than the taking of a photograph; but with a small camera there is a natural reluctance to spread out the party too widely, since the figures are then so very tiny; though one must not overlook the possibilities of enlarging. A picnic or a tea-table party will often make a good arrangement for such a group. The different individuals can be more varied in position, and the meal gives suggestions for a composition in which everyone can have some other occupation than that of gazing at the camera. By compelling the photographer to work from a greater distance also, the problem of getting everyone in good focus is simplified.

It is a mistake to snapshot a group unless the lens is a rapid one, or the shutter can be relied on to give a comparatively slow exposure. The likenesses will be all the better for the work being done in a shaded situation, and there will be much less risk of that bane of so much hand camera portraiture—under-exposure. At the same time, the support of the camera must be something that is fairly high. It will usually be found better in such a case to have to tip the camera downwards a little, so as to get a background that is free from spots of sky showing between trees, which make insistent high lights where high lights are not required. The distortion so produced is negligible in a background of trees or grass.

With cameras of fixed focus it is important to get well away from the group to make the exposure, or the faces will not be quite sharp. The distance of greatest sharpness is generally between twenty and twenty-five feet, for the lens as it is; while if a portrait magnifier is used the distance is too short to include a group at all. This, of course, only applies to snapshot exposures; if a time exposure can be given, we can use a small stop, of course without the portrait attachment, and in that way we can greatly extend the depth of field.

A time exposure is particularly helpful with the cheaper fixed-focus cameras, as they do not usually possess a very rapid lens, nor a shutter that can be slowed down. Their single speed shutters generally give about a thirtieth of a second, and the lens is rarely much faster than f/16. In these conditions, the lighting must be good to get a properly exposed negative of a group with a shutter exposure.

Street scenes are a branch of work often undertaken during a holiday trip. When the subject proper is the actual street itself and its buildings, and the people who may be moving in it are merely incidental, it pays to wait a little to get the best grouping. No attempt should be made to watch the image in the finder; but, having once chosen the viewpoint, examined the finder to see just what will be included, focussed the camera, and set the shutter, the camera may be put down, or held behind one's back, while the scene itself is watched. Then, when the right moment comes, the camera can be brought into position quickly and the exposure made.

Such subjects are often marred by the unintentional inclusion of out-of-focus figures, or persons caught by the shutter in some unnatural-looking attitude. A sharp lookout should be kept to avoid these. It is well, as a general rule, not to include in a street scene any figures less than thirty yards away, and then not if they are moving across the line of sight, or they may appear blurred. There is a much greater chance that they will look natural if they are moving to or from the camera, or, at any rate, obliquely.

It is most important to know how near an object can be to the camera and still be in sharp focus; because in street scenes, whether the camera is one of fixed focus type or not, it is almost sure to be used as a fixed focus one—that is to say, with its lens set for " infinity." If not, the more distant buildings—an essential part of such subjects—will not be sufficiently sharp. As just mentioned, it will not do to have figures too near, but buildings or other objects may be near, and if these are at all out of focus it will be very noticeable, and much more so than a similar degree of fuzziness in the distant parts of the picture would be.

An experiment or two, made with the camera and lens before the holiday—plates need not be exposed, if the camera has a ground-glass focussing screen—will give valuable information on this point. It should be obtained for each of the three largest stops, focussing with the stop to be used, until a distant object is just as blurry as can be tolerated. A note can then be made of the point of the scale which gives that degree of softness for the particular aperture in use, and how near an object can then be, for it to be sharply rendered. This is better than referring to " depth of focus tables," which are apt to be misleading.

CHAPTER XXVII

Hot Weather Troubles

THE EFFECTS OF WARMTH ON GELATINE—FRILLING AND BLISTERING—STRONGLY ALKALINE DEVELOPERS—WARMTH AND THE RAPIDITY OF CHEMICAL ACTION—DEVELOPMENT—DRYING.

WITH the coming of summer, the beginner in photography sometimes finds difficulties which he has not hitherto encountered, and it may not occur to him at first that they have their origin in the higher temperature at which he is working.

The most likely trouble will be due to the characteristics of a substance of the utmost importance in photography—gelatine. This forms the vehicle for the sensitive material in all our plates and films, and most of our printing papers. Gelatine when dry is a horny, rather brittle susbtance. Placed in cold water it absorbs this freely, expanding greatly as it does so, and ultimately forming a jelly, which, on being slightly warmed, first softens and then becomes liquid.

Now, it is evident that if we have a layer of gelatine on glass or celluloid, as we have in a plate or film, and we place the whole thing in water, the gelatine will be subjected to a great strain. It absorbs the water and so expands, whereas the glass or celluloid, being a substance which is impervious to water, is unaffected, and remains the same size as before. In the case of paper coated with gelatine, such as we have in gaslight and bromide papers, there is still a strain, although the conditions are not quite the same. The paper itself also expands on wetting, although it does not do so uniformly, expanding more in one direction than at right angles thereto. One effect of this strain is to loosen the adhesion between the gelatine and the support carrying it, until finally they may separate altogether in places. Warmth, it has just been pointed out, softens wet gelatine and ultimately liquefies it; so that in warm weather the wet film is distinctly softer and more easily injured than it is in cold weather. Hence, it is usually in warm weather that we hear most of the troubles classes as "frilling" and "blistering." The great improvements in plate making have done very much to make these hot weather troubles things of the past. Still, they are met with occasionally, so that this chapter, first written many years ago, may not have become obsolete.

Frilling is the name given to the defect when the film of gelatine comes away from its support at the edges: blistering when it shows itself at spots away from the edges. The terms are sufficiently descriptive for the trouble to be identified instantly. A frill or blister does not disappear when the gelatine dries, as the film in those parts has been stretched; and, although it contracts on drying, there will always be a mark of some kind where the fault has been. It is best, therefore, to prevent it from occurring.

The use of warm solutions is the most frequent cause of a frill or blister. It is important, therefore, if hot water has been used in making up any of the solutions, on no account to use the solution until it has gone quite cold. All water used for dilution or for washing should be drawn from as cool a source as possible during hot weather. The various solutions used should all be at approximately the same temperature, for, if they are not, a warmer one will cause the gelatine to expand and soften more quickly, a cold one will cause less expansion; and so the film is subjected to stresses, first of one kind and then of another.

There may be other factors concerned in weakening the film. Most developers are alkaline in character, and alkali has a very marked action on gelatine. The use of a developer strong in alkali may have no evil consequences in winter time; but in summer, when the water may be 10° or 15° warmer, the same strength of alkali may be enough to soften the gelatine. In developers made up with two solutions, the proportion of alkali can be reduced by taking less of the stock solution that contains that ingredient—the No. 2 solution. Another plan is to increase the dilution. Provided the alkali is not reduced to the point at which development is intolerably slow, and provided that dilution is not carried so far as to bring about the same delay, there need be no hesitation about making such a change. It will not affect the final result, so long as we take care to let the solution act for a long enough time.

A third method method is to employ an amidol developer, since this does not need its solution to be alkaline at all. As the standard brands of plates and papers are made for use with any of the ordinary developers in the English climate, one would not recommend the photographer in this country who is troubled with frilling or blisters to change to an amidol developer on that account. But in very hot countries, the amidol developer has much to recommend it on this score.

One other cause of trouble may be mentioned. When a negative or print with its gelatine full of hypo solution is placed in water to wash, the water will pass into the gelatine faster than the hypo solution will pass out, for reasons into which we need not go at present. The stronger the solution of hypo, the slower will be the rate of its removal. This state of things obviously helps to bring the film of gelatine away from its support ; since the water entering faster than the hypo solution leaves, a state of pressure is set up in the film. But this can be prevented very simply. All we have to do is to see that the hypo solution is not too strong. Many of the instructions recommend the use for negatives of a fixing bath of the strength of four ounces of hypo to the pint of water ; but half this strength may be used if it seems advisable, and even one ounce to the pint is sufficient. The only effect of using a weaker solution is to make the fixing slower ; but if we allow for this (and in negative work at any rate it is easy to do so since we have a visible indication of the speed at which the hypo solution is acting), the weaker fixing bath is as effective.

There are various hardening agents—solutions which affect the gelatine and so make it more resistant to the attack of alkalies, warm solutions, etc. For work in the tropics, these may be advantageous, and even at times indispensable ; but one cannot recommend their use in Britain to mask the effects of something that is wrong in the procedure.

If the photographer buys his materials from some maker of repute, and uses them in the way in which the maker states that they should be used, no trouble should arise at ordinary summer temperatures ; but should frilling or blistering be met with, then what has been written above should be sufficient to put the beginner on the track of the cause of his trouble, and, once found, it is an easy matter to remove it.

The various operations which are carried out in turning an exposed plate or film into a finished negative, and in making a print from it, are largely chemical processes, and these are almost always completed more quickly at a high than at a low temperature. In fact, a low temperature may not only slow them down, but may actually prevent them altogether. We have a conspicuous example of this in development with hydrokinone. A solution which is an energetic developer at 65° or 70° F. will cease to have any effect at all if cooled down, long before the freezing point of water is reached. On the other hand, a developer that is quite free from any tendency to fog at 65° F. may hopelessly fog a negative if applied at 80° F. or higher, unless some alteration is made in the formula to prevent it.

Photographers who adopt time developemnt have this important fact of the influence of temperature upon the rapidity of action impressed upon them constantly, for they have to use a thermometer and refer to a table of times and temperatures to learn how long the operation should be allowed, the tables showing that the higher the temperature the shorter the time, and *vice versa.*

If development is not being carried out by time, but by our relying upon the appearance of the negative to indicate the progress of the action, we must, therefore, be careful not to allow ourselves to be misled by any difference due to temperature. The image is sure to make its appearance much more quickly in summer than in winter, other conditions remaining the same ; and it does not do to conclude that the exposure has been too great. It is probably just as correct as those made in winter, and the rapid appearance is due to the fact that the developer is warmer. Not only will the image make its appearance more quickly with the warm solution, but development will be complete in less time also. We have to be on our guard, therefore, in warm weather, not to over-develop.

There is another reason why development is more rapid at a high temperature than at a low one, beside the general rule that chemical operations are more energetic, and this is that a warm liquid softens and penetrates the gelatine more quickly, and leaves it in a more generally permeable condition ; so that the developer gets to work in the film more quickly.

Fixing as well as developing is accelerated, though, as over-fixing is not possible within reasonable limits, this need not concern us, and it is best to be on the safe side, by leaving the photograph in the bath as long at one time of year as at another, if the fixing is done by time. With negatives it is best to be guided by the appearance of the film.

Washing, on account of the greater permeability of the gelatine, undoubtedly is complete in less time in summer than in winter. It is always desirable, for reasons already given, not to prolong the washing unduly. It should on no account be scamped, of course ; but, provided it is thorough, the more quickly it is completed the better. This is particularly important in summer, when the water is not very cold, since wet gelatine is prone to decompose. At all times of the year, but especially in summer, therefore, washing should not be prolonged. The small number of negatives or prints with which the amateur has to deal at any one time, should not take more than an hour to wash, in any case. But that hour must be spent in work, changing the photographs from one dish to another all the time, doing this changing by taking them out individually, allowing them to drain, and then placing them in the fresh water.

For the same reason, when the washing is complete, drying should be carried out as quickly as possible. The higher temperature of summer air helps us in this respect, provided we take care that the air which has to do the drying is not unnecessarily moist. For this reason it is best to wipe the glass side and edges of negatives quite dry ; and with care a good deal of surplus water on the film side can be got rid of by gently dabbing it with a smoothly folded handkerchief. A print will dry much more quickly if it is placed on a sheet of glass, face downwards, covered with a sheet of absorbent paper, and a roller squeegee passed over it once or twice. It can then be peeled off the glass, and will contain a minimum of water to be got rid of by evaporation. Drying should never be done in the dark room, where a big area of wet sink keeps the air moist. Nor should the draining from negatives or prints be allowed to collect in a pool beneath them. What is needed is a current of air; so that a window or doorway is usually the place where the drying is best carried out. On no account must it be done in direct sunshine, which is often hot enough to cause the wet gelatine to run.

CHAPTER XXVIII

Enlarging

ENLARGING IS PHOTOGRAPHING—PATTERNS OF ENLARGERS—THE USE OF A FIXED FOCUS DAYLIGHT ENLARGER—BROMIDE PAPER — EXPOSURES — DEVELOPMENT AND FIXING.

EVERY photographer nowadays starts work with a comparatively small camera, and before long he is sure to wish that some of his best prints were on a larger scale. A print measuring 3 in. × 2 in., or thereabouts, may show a great deal of detail when examined in the hand, but framed and hung on the wall it appears insignificant. Hence the ambition to enlarge ; and enlarging, fortunately for us, is neither a difficult operation nor one that requires a costly outfit.

Enlarging is not a new process to anyone who has taken a photograph. It is only a repetition under slightly different conditions of what he has already done often enough. Instead of setting up a camera before a landscape and exposing a plate or film on it, he sets up a camera before a negative and exposes upon a piece of bromide paper. The camera may be a " daylight enlarger," or an " enlarging lantern," or an " enlarging camera," but however different these pieces of apparatus may seem, they are all essentially the same, each being fundamentally a lens and a camera.

This is so far true that no special " enlarging lens " is required for the work ; all we need is a lens that will photograph the negative, that is is to say, one that will " cover " a plate or film the size of the original negative. We know that the lens originally used to take the picture will do this, since it was so used ; therefore, the lens with which any negative was taken will enlarge from it. And just as a lens that will cover a quarter-plate, let us say, can be used to photograph a landscape miles in extent, so that same lens, if it will cover the negative (and if it was used to take the negative, it must do so), can be used to make an enlargement from it of any size which we can get any form of camera to take. It is sometimes more convenient to have a lens specially for enlarging, but this is only done as a matter of convenience. Optically, the lens with which the negative was taken originally is at least as suitable as any other.

As enlarging is done with a lens and a camera, it will be well to see how these two essentials are represented in the different forms of apparatus which are used. We will take the case of a " daylight enlarger " first, as this is the simplest and cheapest piece of apparatus for the purpose.

This appliance usually consists of a cloth-covered cardboard box, with an arrangement at one end to take the negative to be enlarged, and at the other the bromide paper on which the enlargement is to be made. In between the two there is a division in the box, in the middle of which is a lens. The division is much nearer the negative than the bromide paper, and those who care to note such things will find on measuring the two distances that the proportion between them is almost exactly the same as the proportion between the original and the enlargement. It would be exactly the same if we knew the precise position in the lens from which to take the measures. So that if the enlarger enlarges from quarter-plate to whole-plate —a ratio of enlargement usually spoken of as two, since any linear measurement in the original is doubled in the enlargement—it will be found that the distance of the bromide paper from the enlarger lens is twice the distance of the negative from the enlarger lens. In this apparatus " the camera " with which the negative is photographed is that part of the enlarger that lies between the lens and the bromide paper. The other and smaller division of the enlarger only exists to hold the negative at the proper position with regard to the lens. This other division is generally a light-tight box, as by excluding stray light from the lens it helps us to get a brighter enlargement, just as a long lens hood in ordinary photography helps to give a bright negative ; but there is no absolute necessity that it should be light-tight. As the apparatus is made to work with daylight, and daylight is both plentiful and powerful, the lens in such an enlarger as this may have a very small stop. Consequently the simplest form of lens can be used—merely an ordinary magnifying glass is all that is needed, so that the fixed focus daylight enlarger can be made very cheaply. In spite of this, it will give, within its limits, as good an enlargement as a costly outfit.

In an enlarging lantern, the camera with which we photograph the negative to make the enlargement consists of the room in which the work is being done. It must, therefore, be perfectly dark. The lens of the lantern is the lens with which we take the photograph, and the lantern itself, with its condenser, negative carrier, etc., is merely an apparatus for holding the negative which we are going to photograph, and for illuminating it powerfully and evenly.

A form of lantern known as a "vertical enlarger" has lately come into vogue. In this the bromide paper lies flat on a table from which rises a support carrying an electric lantern, the lens pointing downwards to the table. The higher the camera is moved up the vertical support the greater the degree of enlargement. An ingenious device which is fitted to some of these enlargers automatically focusses the lens, so that at all degrees of enlargement the image on the paper is perfectly sharp.

There is a third arrangement for making enlargements which may be mentioned, although it is not often used by amateurs. It has been used by professional enlargers a good deal in the past, and is constantly illustrated in books on enlarging. In this method there is an opening in the window or in the roof of the room, in which the negative is fixed, all other means of light entering being blocked up. A small camera is fitted over the negative with its lens pointing into the room, and the bromide paper is set up on an easel in front of this lens. If the opening is in the roof, the direct light of the sky is used; if it is in a window, a reflector is set up outside to reflect sky light to the negative. In this method of enlarging the "camera" with which the negative is photographed is the entire room except that part of it that lies inside the little camera that is used.

Bromide paper, that is to say the more rapid kind of development paper, is what is generally used for enlarging, as it keeps the exposures fairly short—with it, they are usually only a matter of a few seconds. It can be bought with a variety of surfaces and tints, but for ordinary work where it is not of any importance to show the utmost detail, the platino-matt or the rough kind should be used. When detail is required a glossy paper may be chosen ; but unless the negative has been fully exposed, and there is detail even in the deep shadows, glossy paper is apt to make these look dull and heavy ; they look less blank when a matt surface is employed.

It is possible to make enlargements on "gaslight" paper, but the exposures are much longer. With electric light, however, they are well within practical limits. If we use gaslight paper instead of bromide paper for enlarging, we shall find that, just as in contact printing, more contrast is obtained than with the rapid bromide paper, so that this is the best material to use when we wish to make an enlargement with ample contrast.

There are slight differences between the patterns of daylight enlargers as issued by different makers, but in essentials they are alike. On getting one home, the first thing to do is to examine it carefully so as to familiarize oneself with its different parts. Then, if it is of the collapsible type, it can be put together in accordance with the instructions supplied with it, taking care that the various joints are properly fitted one to the other, so that the whole arrangement is light-tight.

The negative to be enlarged, if it is on glass, should first have its glass side carefully cleaned, and should then be placed in the holder provided for it at one end of the apparatus. In doing so we must be careful to see that the film side of the negative is turned towards the bromide paper, as, if it is turned the other way, the picture will be reversed as regards right and left. By film side is meant the side coated with the sensitive gelatine emulsion, not the celluloid side in the case of a film negative. Negatives on celluloid film are placed between two pieces of glass to keep them flat while they are being enlarged. If the negative is not the full size of the opening in the negative holder, it is best to fill in the blank parts with strips of black paper or of thin card.

Most of the cheaper forms of daylight enlarger are not provided with a separate dark slide to hold the bromide paper.

The whole arrangement is carried into a dark room and a piece of paper is put in there. The usual method is to have a sheet of glass in the enlarger, on which the bromide paper is placed and pressed down into position by putting on the back and fastening it down. Needless to say, this glass must be clean, dry, and flawless. The paper being inserted in the enlarger, it is ready for exposure. Some enlargers have a little shutter over the lens, which can be opened by pulling a knob at the side ; but this is not a necessity, as it is sufficient to throw a focussing cloth over the negative end, or to make a cardboard cap for it, to keep it covered until the moment arrives at which to expose.

The light used in enlargers of this kind is the direct light from the sky, which is allowed to strike straight down upon the negative, the enlarger being stood up on its end for that purpose. Sunshine must not be allowed to get to the negative, but short of that a strong light does no harm. The enlarger should not be moved during exposure or the negative may move slightly and the image be duplicated.

It has been pointed out that the lens in the ordinary fixed-focus daylight enlarger works at a very small aperture ; and one result of this is that it may not only give us a sharp picture of the negative, but it may also depict, more or less sharply, objects that are a long way from the negative. Thus it will very likely happen that if the enlarger during exposure is so placed that there are trees or chimney tops behind the negative, these chimneys or trees may show themselves as blurry dark patches in the enlargement. It is, therefore, important to see that there is nothing but an uninterrupted view of the sky behind the negative.

In enlarging, as in all other forms of photographing, the exposure is all important ; and if we are dealing with daylight, which varies from hour to hour, we cannot adopt any hard and fast rule such as can be used for contact printing by some steady form of artificial light. We must measure the light with an exposure meter, and see how it varies ; and, as a matter of fact, there is no branch of photography in which a meter is of more service than this. As the lens and stop do not alter with different enlargements, and we can keep to one speed of bromide paper, the calculating part of the meter is not required. All we have to consider is the strength of the light, and the character of the negative.

When first using the enlarger, the light must be measured by seeing how long it takes the meter paper to darken, holding the meter turned upwards to the sky, in the position to be occupied by the negative in the enlarger. Unless the light alters visibly during the operations this preliminary measurement will be enough ; but if there is a noticeable change, the light should again be measured and averaged.

The correct exposure at first should be found by a series of trial strips, covering the negative with an opaque card a little at a time, after the lapse of, say, two, four, eight, and sixteen minutes from the commencement of the exposure. A small piece of bromide paper for trials is generally included in the packet, and this will subsequently be of service ; but for the first exposure of all, it is best to use a whole piece. On development it will be seen which of all these exposures is nearest correct, and then a second piece can be given the exposure indicated, which should prove right ; or, if the beginner is in any doubt, he may expose the second piece also in a series of trial strips, but with much smaller differences. Say, for example, that the first piece shows the correct exposure to lie somewhere between two and four minutes, the second strip may have two and a half, three, and three and a half minutes, so that the third piece may be given the exact exposure. A note should be made of the negative, of the time taken for the meter paper to darken, and of the correct exposure when found. Thereafter, whenever the light is of the same strength, and we are using the same bromide paper, and a negative of similar density and colour, the exposure will be the same, or, if the light is different the meter will indicate the extent of the difference.

There are several developing agents which can be used with bromide paper ; but those most commonly employed are amidol and metol-hydrokinone. Some of the concentrated single-solution developers are also used. Different developers give slightly differing tones to the pictures ; but these variations are only very slight indeed—or at least they should be if the developer is in proper working order and the paper has been exposed correctly. Amidol gives a little bluer black than metol-hydrokinone, but it would take a very skilled photographer to say off-hand which developer had been used.

What is most important is that the developer should be in good order. In this amidol has a great advantage, as it will not keep. In other words, it spoils so quickly that it is seldom used except when it is freshly made up. It is very soluble, so that little time is spent in preparing the solution, and when it is used within an hour or two of its preparation we may be quite sure that it is in what may be regarded as the ideal condition for a photographic developer. Metol-hydrokinone having better—but not indefinite—keeping properties, there is a greater risk that it may be used when it is no longer in good condition. If the reader does not know which developer he should use, he will do well to choose that recommended by the maker of the bromide paper he is using.

Whenever we are developing, whether it is a negative or a print, it is important to get the developer all over it as quickly as possible, or we shall get uneven action. In the case of enlargements, as we are dealing with a greater area than usual, it is a help to soak the paper in water before applying the developer. For this a quarter of a minute or so is ample ; in this time the sheet will have become limp, and the gelatine surface will no longer be repellent ; the paper will lie flat on the dish, and the developer can be poured over it in an even wave.

Large porcelain or xylonite dishes are expensive. Papier mâché dishes are as convenient, and much cheaper. They are light and unbreakable, and the bottom being flat and not grooved, the enlargement lies smoothly in the dish. If they are stood up to drain and dry after use, instead of being left with liquid lying in them, they will last a very long while. I have a couple which have been in frequent use for the last sixteen or eighteen years, and are as good as ever. For occasional work, a tin dish or japanned tray does as well ; if of bare metal, it should receive one or two coats of Brunswick black.

I need not describe the development of an enlargement in any detail, as it does not differ from that of a print made by contact. The image appears gradually, the time varying with the kind of developer used, its strength, the temperature, and the exposure. If the exposure was correct, it grows steadily in strength until it has the full vigour required, and then the action seems almost to stop. This slowing down must be looked for, as has been already mentioned, and it is important to carry on the development until there is no doubt about it having taken place. There need be no fear of over-development.

Development tells us whether the exposure was correct or not. If the paper was over-exposed, the image will come up quickly, and when the picture is fully out, instead of the action appearing almost to stop, the darkening will continue. In such a case as this, nothing is to be gained by stopping the development before this heaviness comes on ; the result will only be feeble and poor in colour. On the other hand, an under-exposed enlargement is shown by the developing action stopping before the picture is fully out. There is no remedy in either case, and no process that will even effect an improvement. We must be content to regard the paper as wasted, and make a fresh exposure.

Under-exposed enlargements are sometimes found to be badly stained in development, and one may be puzzled as to the connection between exposure and staining. No error in exposure can, of itself, cause a stain, but the attempt to correct that error by prolonged development may do so. The composition of any of the developers in general use is such that from the moment at which development begins the developer begins to oxidize, and the products of oxidation are dark coloured substances which stain both the paper and gelatine, and sometimes the fingers of the operator.

As soon as we are quite sure that development is complete, the enlargement should be rinsed in one or two changes of water and put into the fixing bath. The rinsing is not a necessity, but it is advisable, for reasons which the previous paragraphs will have made clear. Some workers use a plain solution of hypo for fixing, while others prefer an acid-hypo bath. The difference of opinions shows that the choice is not important, and the best plan for the beginner is to do whatever is recommended by the maker of the paper he happens to have chosen. It is important to use a fixing bath of the strength specified, and for the specified time, as the operation of fixing is not a visible one, and these are the only guarantees we have that it is going on as it should. The dish should be rocked occasionally, both to bring fresh hypo solution next the paper, and to help to wash out the developer.

The fixing and washing of an enlargement are done in exactly the same way as in the case of a gaslight print. What is required is frequent changing of the water, making each change as complete as possible. A dozen changes, of the right kind already described are ample. In the case of an enlargement of any size it may be convenient to throw it over a line and let it drain while the dish is emptied, rinsed out, and refilled. If it is washed in a dish, it may be turned over from time to time, so that, say, half the changes are given with it face upwards and half face downwards. After the last change has been given, it should be hung up to drain and dry, out of reach of dust.

Enlarging with a lantern may be regarded as a little more advanced than a beginner would wish to undertake; so it may be left out of consideration here. But there is so much that can be written, both on work with an enlarging lantern and on enlargement generally, that those who care to follow up the subject further should consult the book entitled "Photographic Enlarging," by the writer, which is also published by Messrs. Iliffe and Sons, Ltd.

It will be well if the reader does not attempt anything very large in the way of enlargements at first; as he is bound to have a few failures, and this will limit the expense to which his mistakes put him. When he gets more skilful he can make bigger pictures; as with an enlarging lantern, there is no limit within reason to the size they can be made. In fact, the limitation imposed is more likely to be from the size of the dishes than from anything else. All that has to be done to get a bigger picture is to increase the distance of the lantern from the easel, and allow for the increased exposure due to the light being spread over a larger area.

Enlarging is a very fascinating branch of photography; especially enlarging with a lantern rather than with an apparatus of the fixed-focus type. The lantern allows us to go over our negatives and pick out any part we fancy, enlarging that to the full size of the required picture.

We can get the image as sharp as the lens will give it; or, if we like, we can introduce more or less softening or diffusion at will. This is done by putting loosely over the lens of the enlarger a piece of black chiffon: or by a sheet of a fine fabric known as bolting silk or bolting cloth, stretched on a frame or sheet of glass and placed just in front of the paper on the easel, though not in actual contact with it.

CHAPTER XXIX

Making Lantern Slides

SLIDE MAKING ESSENTIALLY PRINTING ON GLASS—LANTERN PLATES—DEVELOPING A SLIDE—MASKING—BINDING A LANTERN SLIDE—SPOTTING—SLIDES BY REDUCTION.

LANTERN slide making cannot be pursued successfully without a lantern for showing the slides. It is only by actual projection that we can test our work and make sure that it is right, or else see its defects and learn to remedy them. This applies to expert workers as well as to beginners : hence we often read in exhibition rules that " the slides will be judged in the lantern." This need not act as a deterrent, however, since most photographic societies own a lantern, and many of them notify their members that their slides can be tested in it at certain times. Even those who live out in the country away from any camera club will usually find that the clergyman or schoolmaster has a lantern which he is only too pleased to lend, especially if he can hope in return to borrow some slides of local interest to be shown in it.

Slide making is, in its essentials, printing from the negative. The print is made on glass instead of on paper, and is seen by projection on to a screen instead of by reflection from its surface ; but otherwise the two are identical. I have sometimes been asked why a negative itself cannot be used as a lantern slide : the answer to which question is that it can, but that in such a case the projected image will be a negative instead of a positive—its light and shade will be reversed. Moreover, for reasons into which it is not necessary to go here, the negative, if good as a negative, would be poor as a slide : the character which a good lantern slide should possess is quite different.

Lantern plates, which can be obtained from any dealer, are glass plates that have been coated with an emulsion, similar, in a broad sense, to that upon the plates and films we use for negative work, but more similar to (in some cases identical with) that upon bromide or gaslight paper. On such plates lantern slides can be made in a printing frame in much the same way as prints are made, provided always that the negative is of suitable size. This is important. For convenience in showing, a standard size for lantern slides has been fixed, which in this country is 3¼ × 3¼ inches. If we are to print our negatives on plates of this size in a printing frame, it is evident that the picture on the negative must not be larger then this—in fact it must be smaller, to allow for what is called masking and binding the slide.

If the picture on the negative is too large, slides can be made from it by what is termed "reduction." In this case the negative is fixed up and illuminated from behind, and is then photographed with the camera, using a lantern plate and focussing the image so as to bring it to the size required. In distinction from this, the method of making lantern slides by printing in a printing frame is called "slide making by contact." It is this latter method, as the simpler, which will be here described.

Lantern plates are obtainable in several kinds, but there are two principal classes—"slow" or plates for warm tones, and "fast" or plates for cold tones. Either kind will give a fine black tone at will; but for brown, purple, or red images the slow plates must be used. When slides are being made by contact, the necessary exposures are so short that it is immaterial whether fast or slow plates are used. Probably the beginner will do well, if his dealer stocks both kinds, to get a box of a slow variety by one of the standard makers, and to start by getting black tone slides upon them. A suitable formula for development is given with the box of plates; but one of the single-solution developers, such as Azol, or the tabloid Rytol, can be used quite as well. It is only when warm tones are required that the makers' formula becomes imperative.

With a box of such plates, a printing frame, some developer, and some hypo solution, slide making by contact can be put in hand forthwith. There is no need to use a deep red screen in the dark room lamp, a bright yellow will be safe, and will allow much more light to pass, so that we can see what we are doing. The printing frame should be seen to, that its springs are not so strong as to endanger the negative when, instead of a piece of paper, another thickness of glass is pressed down upon it.

The negative should be carefully dusted lest there should be any particle of grit upon its surface, and the lantern plate (in a dark room, of course) is laid down upon it, film to film. We must be particularly careful, when doing this, not to slide one on the other, or we may get scratches or pinholes. For this reason, if the lantern plate is not the same size as the negative, we should settle beforehand just where the plate is to be put down upon it to bring the image in the right position on the slide. (There are special lantern slide printing frames, but they are not a necessity, although certainly convenient.) The back of the frame is then fastened in, and exposure made just as when making a print on gaslight or bromide paper.

For plain black tones, the exposure will depend on the sensitiveness of the lantern plate, the opacity of the negative, the strength of the light, and the distance of the printing frame from it. As these factors may all vary greatly, I can only say that we must be guided at first by any statement as to exposure made in the instructions issued with the lantern plates, and learn from the results. As in the case of printing by artificial light, the first exposures may be made by shading part of the negative with a card, so that each plate exposed has three or four different lengths of exposure recorded on it, which, on development, will indicate, approximately at least, what is the correct exposure.

In exposing it is also important always to have the printing frame at the same distance from the light, as if that distance is merely guessed at and varied there will be variations in the exposure on which we had not counted, and trouble will arise. The exposure may be made to the light from the dark-room lamp by lifting the light filter, or an incandescent gas burner or lamp can be used. Very slow plates are sometimes exposed by burning a measured length of magnesium ribbon at a certain distance in front of the printing frame.

The development of a lantern plate is similar to the development of a negative, except that the character of the final result must be altogether different. In a negative the colour of the image is of no great importance; but in a slide it is the image on the slide that is seen, and it must therefore be of a colour that is agreeable to the eye. Moreover, in a negative a slight veil over the whole image matters little. It merely means that the exposure given in printing must be longer, to compensate for the veiling, but a veil on a slide means a dulling of the picture on the screen, and so is undesirable. There should be some slight deposit everywhere, even in a lantern slide, or gradation in the highest lights will be missing; but in the high lights it must be of the faintest character only.

As the extent of development is important, this operation should be carried out in a good yellow light, in which we can see comfortably what we are doing. The image soon appears; and when all detail is visible, if the plate is looked through, at a good light, the picture will appear very weak; so the action of the developer must be allowed to go on. Gradually it will increase in strength, and it can be examined from time to time, until, viewed by transmitted light, the picture seems vigorous enough. At this point it will look dark and heavy as it lies in the dish; although any parts of the plate that have not been exposed at all should still appear perfectly white and unaltered. It is then transferred to the hypo bath for fixing. There is no need to use an acid fixing bath for lantern slides, although some workers prefer it.

In the case of developers that contain hydrokinone, however, as, for example, any of the popular M.Q. formulæ, it is important to wash the slide between development and fixing, either in running water for half a minute, or in two or three changes. If this is omitted there is a risk that an intense yellow stain may show itself later on, for which there is no effective remedy. The washing should not take more than about half a minute, as, until the plate is fixed, it will go on increasing in density.

Thorough fixing is as important in the case of lantern slides as it is with negatives or prints, and the slide should therefore be left in the hypo bath until the whole of the whiteness visible at the back has vanished and for as long again. Lantern plates usually fix much more quickly than negative plates. The slide is then washed in exactly the same way as a negative, and dried. When washing is complete, the slide should be held under the tap, or under the surface of some clean water in a dish, and its film gently rubbed over with a tuft of cotton wool. This will get rid of any superficial deposit of lime salts, generally present when the water is hard, which would be unsightly if allowed to dry on. The drying must be carried out in a place that is quite free from dust, as any dust on the slide will be magnified on the screen.

If the slide at this stage is put film downwards on a sheet of white paper, the picture on it should look distinctly darker than it would do were it a print ; but on holding it a little way off and looking through it at the paper, it should appear clear and bright, with all the vigour which we should wish it to present when projected. This holds good with black tone slides, which can be judged fairly well without actual trial in a lantern. Slides that have been developed to give warm tones are apt to be misleading, however, when they are merely looked at in the hand.

Nothing more remains but to mask and bind up the slide ; but it is best for the beginner to defer these operations, at any rate in their final and complete form, until he is sure that the slide is a good one. He may, therefore, content himself by placing on the film of the slide a temporary mask and protecting glass. The mask may be made by cutting a square opening about three inches each way in a piece of opaque paper, which is then trimmed to the exact size of the lantern plate. A spoiled slide may be placed in hot water to bring off the gelatine upon it, given a scrub to get the glass quite clean, and then dried. It is put down upon the slide, with the mask in between, and attached by means of a couple of strips of gummed paper along two opposite edges. The slide is then ready to be tested in the lantern, and if approved may be permanently masked and bound up.

The masking may be regarded as equivalent to the trimming of the print, those parts of the image which are not required in the picture being covered over with opaque paper, instead of being cut off with a knife. It follows that the same questions—what to include and what to omit—that arise in trimming the print come up for answer in masking the slide; and much the same considerations apply. We must be careful not to be prejudiced in favour of including too much, just because it happens to be in the negative. More pictures are spoiled from a reluctance to cut away non-essentials than ever are injured by too drastic elimination; and it is well, therefore, to be on one's guard against such a mistake.

Ready-made masks can be bought, just like ready-made mounts, but these should be left for use by commercial slide makers. The size and proportions of the mask should be governed by the requirements of the picture, and not by the possession of a ready-cut mask. There is no need, however, to cut masks for slides, as they can be built up on the slide itself from pieces of the same opaque paper that is used for binding the slide. The opaque paper used in film packs will be found very suitable masking paper. All we need is a supply of such pieces, preferably of various widths, and each 3¼ in. long, or slightly less.

To mask the slide, it is placed, film upwards, on a sheet of white paper, so that the image can be clearly seen, and a piece of the opaque paper is touched on its underside with gum, or, if it is a gummed strip, it is moistened, and put down on the film, so that the straight edge of the strip comes just where we intend the bottom margin of the picture to fall. It is then rubbed down into contact. It must be put down in the correct place once for all, as it will be found that it adheres to the gelatine directly and cannot be moved about. The top margin is then covered over by another strip in exactly the same way, and then the two sides.

It is important to get the margins exactly parallel with the edges of the lantern slide so that the angles of the mask may be square. Some workers have a sufficiently straight eye to do this without any mechanical aid; but those who have not can make a little appliance for the purpose in a few minutes, which will be found helpful.

For this purpose, a sheet of white card a few inches square is taken, and a series of fine black lines are ruled across it an eighth of an inch apart. A dozen such lines are sufficient.

A strip of the same card about three inches long and half an inch wide, with one perfectly straight edge, is then stuck down on this card, so that its straight edge exactly coincides with the first of the ruled lines. In use, the slide is placed over the ruled lines, which can be clearly seen through it, and pushed up against the edge of the card. It is then easy to put down the strip where required, so that its edge is parallel to one of the lines. By turning the slide round and pushing it up to the card each time, we can get all four strips exactly parallel with the edges of the glass, and if they are so placed the angles of the opening which they surround will be right angles.

When the strips have stuck down, if any of them project beyond the glass we can put the slide, strips downwards, on some suitable surface, run a knife round to trim off the excess, and the slide, when the adhesive is thoroughly dry, is ready for binding.

The next operation is to attach the cover glass. This may be a spoiled lantern plate from which the film has been removed by soaking it first in cold water for a little while, and then putting it into hot water. It is finally well scrubbed, dried, and polished.

Gummed binding strips can be bought either in lengths sufficient to go round a slide, or in pieces 3¼ in. long. The former are preferable, as they can be cut up as required, and are useful for a variety of purposes beside that for which they are sold. The beginner will find it easier to cut up the strip for binding, although some workers bind all four edges at once with the single strip.

A piece of the required length is moistened and left lying on the table, gummed side uppermost, until thoroughly limp. The slide with the cover glass laid down upon it is held by opposite edges, and one edge is pressed down firmly upon the centre of the gummed strip. It will adhere and can be picked up. The slide is turned over, so as to bring the edge with the strip adhering uppermost, and the overhanging parts of the strips are smoothed down on to the glass on each side. When one edge has been done in this way the opposite edge is bound in the same manner, and when both these are done it is best to put the slide aside for a little while for the gum to dry before doing the other two edges. There will then be much less risk of shifting the strips that are already in place when finishing off the corners. Some slide makers snip off the corners of the strips so that in the bound slide there is no overlapping, but this is not necessary. It is even better not to do it, as there is less chance of the binding peeling off if it is stuck, paper to paper, at the corners. Gummed paper has a trick of peeling off the glass when it gets very dry. To prevent this, a mixture of sugar and water has been suggested for moistening the gum on the strips; paste seems even better.

It only remains to "spot" the slide. This is done to indicate to the lanternist the correct way of putting it into the lantern carrier. That way, by general agreement, is now indicated by two conspicuous spots, which are so placed that when we hold the slide and, looking through it, see the picture the same way round as it is to appear on the screen, the spots are at the two top corners on the side that is next the eyes. The neatest spots are made by gumming two little circles of white paper on to the slide in those corners. Such spots, ready gummed, can be bought, but anyone who can borrow one of the paper punches used in offices can make a hundred or so in a few minutes. They are less likely to be removed on cleaning the slide, if they are put on under the cover glass attaching them to the top strip of the mask.

As has already been pointed out, when the negatives are too large for slides to be made from them or part of them by contact, they can be made in the camera. As the novice is not likely to have such negatives, and as, in any case, the work may be regarded as more advanced, any detailed description would be out of place here. The only essential difference, lies in the method of making the exposure: when once this has been done, the development, masking, binding, etc., are carried out in the way just described.

CHAPTER XXX

The Care of Apparatus and Materials

CARE OF THE CAMERA—DAMP—KEEPING THE LENS CLEAN —STORING SENSITIVE MATERIALS—THE RISK OF IMPURE AIR—REPACKING PLATES AND PAPERS.

FEW pieces of mechanism of any kind suffer so little from legitimate use as a camera. The actual wear and tear to which it is exposed by the taking of a photograph is almost nil, and it is mostly carelessness or misuse that puts it out of order. If it is laid aside for a time, and is improperly stored, it may suffer more than it would have done if it had remained in service. What follows on the topic of the care of our apparatus is to some extent a recapitulation.

A camera that is not as good as new may be imperfect in one or two directions, putting on one side any mere damage to its polish or appearance. It may no longer be light-tight, and it may have its adjustments slack and inaccurate.

To keep it light-tight, it should be sufficient to protect the bellows from physical injury, to see that none of the screws holding the lens, etc., are missing, and to preserve it from damp, which, by causing the wood to warp, or the glue to give way, soon puts a camera out of commission. It should therefore be stored in a reasonably dry place, and if in use it has got wet with rain no time should be lost before wiping it as dry as possible, and leaving it extended and open in a moderately warm room for any traces of moisture to evaporate. A sheet of waterproof cloth is a good thing to have in the camera case. It makes an excellent focussing cloth, and when wrapped round the camera protects it not only from rain, but from dust, scratches, and rubbing.

When a magazine camera is put on one side for some time in a damp place, the sheaths may get rusty. It is not practicable for the amateur to restore their surface to the fine black condition in which they are sent out when new, but rusty sheaths can be made workable easily enough. Each sheath is well rubbed with fine glass paper to remove the rust, and is then given a coat of dead black varnish, which can be bought from the dealer all ready for use.

Injury is often done to a folding camera immediately it comes into the possession of the beginner. Some patterns have tricky catches or springs, the function of which is not manifest on the surface, and when the user finds that the camera will not open or fold up as he thinks it should, he uses a little force and strains some part of it. The only safeguard is to be sure the camera is understood before handling it, either by getting the dealer to demonstrate its manipulation, or by careful study of the instructions.

With box-form cameras the changing mechanism is the part most likely to be put out of order. With folding cameras it may be the baseboard, or, more likely still, the front. In a camera in good condition, the front, when set up and clamped, should be perceptibly one with the rest of the instrument, and should have no play at all at its top end. When once it has been strained it is no longer in that condition, and the camera is to that extent inefficient.

It comes to this, that the camera should never be forced. If its different parts do not move easily and smoothly, the cause of the obstruction should be found and removed. It may be that a catch has to be released, or that some particular part of the instrument has to be in some particular position, and is not so. On closing a folding camera of the hand or stand type, for example, the front must be central before it will go properly into the back, and the rack must be wound home. It should have a case, and be kept in it when not actually in use.

As far as the care of the lens is concerned, it may be summarized by saying that it should, as far as possible, be left alone. Short of dropping it or striking it, the thing which damages it most is cleaning it. One is apt to overrate the hardness of glass and to forget that rubbing even with a soft cloth may damage a highly polished surface if that surface is dusty, as presumably it will be, or the rub would not be required. It is a common sight to see a photographer breathe on the surfaces of his lens and give them a good polish with his handkerchief or with the corner of the focussing cloth. The result of this is that the lens soon loses that black polish which every good lens possesses when it leaves its maker's hands, and the surface becomes greyed over. As far as the working of the lens is concerned, this greying from frequent rubbing is more detrimental than a scratch or even a crack might be. Many a cracked lens will give a good bright image; but no lens with depolished surfaces will do so. The negatives become fogged from scattered light.

What we have to do, then, is to avoid the necessity for cleaning the lens as much as we can, by protecting it from dirt. The surface that is inside the camera will generally keep clean for a long while if the instrument is of an enclosed type, such as a box-form or a roll-film camera. It is the front surface which is most likely to get dirty, especially as with many patterns fitted with a diaphragm shutter it seems to be customary to send out the lenses unprovided with any kind of cap. There should always be a cap, and if one is not provided it should be bought or made. It should be kept on, except just when the camera is to be used: and if this is done there will be no necessity to wipe the lens until it has had months of work.

Whatever cleaning is necessary should be carried out by the gentlest possible rubbing with some very soft, clean fabric, such as an old much-washed handkerchief. The inner surfaces of a lens should not need wiping at all in the ordinary course of things, as most lenses now are well enclosed. This is just as well, as unscrewing the combinations frequently is another thing to avoid. The mounts are of thin metal, and the threads of the screw are necessarily fine and easily injured, particularly so in the case of lenses mounted in aluminium. There is also the risk, when a lens is taken to pieces, of not putting back its components correctly.

A shutter lasts longer in working order if it is handled no more than is necessary. It should be protected from dust as much as possible, as cleaning a shutter, except with a few simple patterns, is a job for its makers or for a skilled mechanic. On no account must the shutter mechanism be oiled. If the shutter is actuated by a spring, whenever the camera is put away for any length of time the tension on the spring should be released, if this is provided for, as it is then not likely to change in strength, which it might do if it remained fully wound.

Anyone who takes up photography is brought for the first time into contact with preparations which have a degree of susceptibility to injury altogether greater than that of anything of which he can have had previous experience. Some of the things with which we deal in ordinary life are injured by damp, some spoil on exposure to heat, and some from the action of the air ; many are easily damaged by scratching or rubbing. But in photographic plates, films, and papers, we have manufactured articles which have all these susceptibilities, some to an enhanced degree, and others peculiar to themselves. The faintest beam of white light will instantaneously affect some of them, and others, if not quite so sensitive as that, are soon injured by white light of any intensity. Subtle emanations, capable of passing through paper, card, and even thin metal, may leave their trace : while the lightest touch of an apparently clean finger may show as a blemish in the final photograph unless laboriously painted out.

It is clear, then, that the novice has to revise his notions of what constitutes careful handling ; but it is clear, also, from the flawless results which many workers regularly produce, that in spite of all this, it is still possible to keep and handle such goods without damaging them.

As regards storage, a few hints will suffice, and they may take the form of warnings of what to avoid. The beginner has bought a box or two of plates or a roll or so of film, which he may not see a prospect of using for a little while ; where are they best kept ?

They must not be put where they will get damp, nor hot. The products of burnt gas are very inimical ; so that a high shelf in a room likely to be artificially warmed and lit is to be avoided. The air is always foulest and hottest near the ceiling : how bad it may be is often not suspected until some job necessitates bringing one's head much higher than usual. Sulphuretted hydrogen, the gas responsible for the smell of rotten eggs, speedily spoils any sensitive photographic material, so that such should not be stored in a dark room or laboratory where sulphuretted hydrogen may be present. There are other possibilities of injury in a laboratory ; as the X-rays, emanations from compounds containing uranium, and from certain rare earths, some of which are present in incandescent gas mantles, are all capable of affecting photographic preparations, even when these are packed in boxes or cartons.

These exclusions leave plenty of places where such things may be kept, however. Any reasonably dry drawer or cupboard, such as would be used for clothes, is very suitable. It is best, but not absolutely necessary, to keep them where they are not constantly exposed to daylight, since if there did happen to be some slight light leakage in the packet, the cupboard or drawer would help to protect them.

The packing of such materials has been the subject of much carefuly study, and anyone buying any of the standard brands can rely upon it that the packing used has been carefully chosen for its harmless nature. Therefore, when once a box or a packet has been opened, if its contents are to be put away again, the makers' packing should always be used. Although at one time plates were packed with sheets of specially pure paper between the films, trouble arose from emanations from the paper affecting the emulsion, and so the general practice now is to send them out with nothing between each pair of sensitive surfaces, except the thin separators of a special cardboard along two opposite edges.

Much the same may be said of sensitive papers ; it is wise to use the makers' packing as far as we can. With gaslight paper, particularly that with a glossy surface, we must be careful to avoid " friction marks."

In the dark room, sensitive material should never be left lying about unprotected, since the safest of safe-lights will fog it, given time enough. Hence the convenience of a drawer or box, into which it can be slipped ; and the advantage of a cover of some kind, to put over the dish during development.

With ordinary care, these highly susceptible materials can be kept in good working order for a very long while. There seems to be no limit, in reason, to the keeping of plates and bromide papers—after twenty years or more they should be as good as ever. But as their condition depends on *how* they have been kept, one is always safer with fresh materials. P.o.p. is best used within a month or two. Celluloid film gradually deteriorates, but even then it is a matter of years, in climate such as ours ; and the date marked on it, to be on the safe side, represents quite an underestimate of the time during which it may reasonably expected to be in fine condition.

CHAPTER XXXI

Cleanliness

MATERIAL OF THE VESSELS USED—ALLOWING LIQUIDS TO DRY ON—WASHING BOTTLES—WIPING SHOULD BE AVOIDED—CHEMICAL DUST.

THE practice of photography is in itself a valuable training in neatness, cleanliness, and the importance of little things; as well as in other directions which need not be specified at the moment. As far as cleanliness is concerned, there are no other operations which the average person has to perform, in which this quality is so important. One may say without any fear of contradiction that a vessel that is not clean enough to be used for food or drink, is certainly not clean enough for photographic purposes. Washing figures largely in all photography, therefore; and one cannot select a subject of greater importance to the novice than that of the steps to be taken to get clean, and to keep clean, his various appliances.

Glass vessels have two advantages from this point of view. Many kinds of dirt are at once visible on their surface; while glass itself is so inert that various corrosive liquids may be used, if necessary, to get the glass perfectly clean. Earthenware is less suitable, because it consists of a porous, absorbent material, with merely a thin coating of glaze on its surface. As soon as this glaze has been penetrated, the material beneath will act like a sponge and suck up any liquid that may get through the surface layer, retaining this in spite of repeated washings and soakings, although always ready to impart enough to contaminate any other solution that may be put into the vessel. Xylonite is more easily surface-stained than glass or earthenware, because the surface is not so polished and is therefore more difficult to clean, but, on the other hand, the material is impervious and is not liable to crack, so that for dishes it is better than any other. It cannot be used, however, for warm liquids, as it distorts badly when exposed to heat.

For certain purposes metal answers very well. Developing tanks are made of nickel-plated metal; and even ordinary tinplate, if given a coating of varnish or brunswick black, is useful. If left wet, it is liable to rust: and acid solutions should not be left in contact with bare metal at any time. Corrosive liquids must not be used to clean metal; for this purpose water is sufficient.

A great deal of the work otherwise required to keep the things clean can be avoided by making it a rule never to put away anything after use without first washing it out. So long as it has been kept wet, little trouble is generally needed to clean it; but if once liquid has been allowed to dry on, if it is only just round the edges of the solution, the task of getting that vessel clean again becomes much harder. In fact, with glazed earthenware dishes it is not too much to say that when once liquid has been allowed to dry in them, it will never be possible to make them perfectly clean again. Nothing causes the glaze to crack so readily. At one time it used to be said that different dishes should be kept for the different operations, to avoid all chance of contamination. There is nothing in the ordinary processes of modern photography, however, to necessitate anything of the kind, if reasonable care is used in washing. A question often asked is whether negatives can be fixed in the metal tank in which they are developed. There is no reason why they should not. Of course, the tank must be well washed out after fixing before using it for development again; but this should be done in any case.

When vessels are wiped, there is a risk, in wiping them, that some impurity will be transferred from the cloth used to the surface. The wet glass allowed to dry unwiped will not have so clean and bright a look as if it had been wiped dry, since almost all water contains traces of salts, mostly compounds of lime, which will be left behind as the water evaporates; but these salts are not harmful. If they were, it would be an indication that the water used was unsuitable for photographic purposes.

Those substances that are soluble in water will be removed by a succession of rinsings ; but insoluble deposits are sometimes formed, and these may require some friction to remove them. A wet rag will generally be sufficient, and anything that this will not get rid of can be removed with a nail-brush and a little gritty soap, such as " Monkey Brand." It is best not to use this for earthenware any more than is necessary, as it tends to destroy the glaze ; and if solutions are not allowed to dry on, it should not be necessary.

In the same way, bottles should be washed as soon as they are emptied. If they are not required for other solutions at once, they may be filled to the brim with clean water and corked or stoppered. Then when wanted, they are emptied and rinsed, and one may be confident that they are clean.

As a brush cannot get at the whole of the interior surface of a narrow-mouth bottle, if there is any deposit that rinsing will not remove, some tea leaves or snippets of paper and a very little water may be put into the bottle and vigorously shaken. This will usually rub it quite clean. Bottles that have held solutions of carbonate or of caustic alkali are generally marked indelibly. This is unsightly, but if the bottle has been well washed it is not dirty. The alkali attacks the glass itself, and leaves it rough.

When soap has been used to clean any vessel it must be thoroughly washed off afterwards, as most cheap soaps are themselves strongly alkaline, and might be as injurious as any other dirt. After rinsing, measures and developing cups should be left upside down to drain and dry. Pegs projecting upwards from a shelf are handy for the purpose, or notches may be cut in the edge of the shelf to take the feet of the vessels. This is better than putting them uspide down on the shelf itself. By keeping such articles in this position when not in use the inside will be free from any chemical dust which might be floating about and settle on them.

Judging by the number of instances which occur of mysterious spots forming on negatives or prints as they are left to dry, which can only be attributed to chemical dust of some kind, a great many workers are not alive to the injury which it can cause. It usually originates in spilt solutions, which, instead of being wiped up at once, are allowed to dry.

The solid matter contained in them is then left behind in a fine powder, which, if swept or dusted up, will pass into the atmosphere and settle upon surfaces where it may do much harm. Developers and hypo are amongst the most dangerous of chemical dusts to be met with in the workroom.

Enough has been written on this topic to show the reader how to avoid the defects which originate in a want of proper cleanliness. The precautions named may seem rather fussy at first, but they should be practised until they become almost second nature.

CHAPTER XXXII

What not to do

WORK THAT IS BEYOND THE NOVICE—LIMITATIONS OF HIS OUTFIT — HIGH-SPEED PHOTOGRAPHY — PANCHROMATIC WORK—FIRELIGHT PICTURES—MORE ADVANCED PRINTING PROCESSES.

IT is quite natural that the beginner should attempt many unsuitable subjects, being unaware of the difficulties they present. One must aim at producing good work, if success is to be reached ; but aiming too high is almost as great a mistake as aiming too low. That is why I have advised beginning with comparatively straightforward and easy subjects ; otherwise disappointment may result in the photographer being so disheartened as to throw up the pursuit in disgust. It may be helpful, therefore, to suggest to the beginner what he should not, at present, attempt.

In the first place, he should thoroughly understand the limitations of his outfit. The subject is one which, possibly, he did not consider before getting his apparatus.

I have so often been asked whether such and such a hand camera is suitable for " general work," without any indication of what the enquirer means by " general work." Sometimes the enquirer states that he means snapshotting of landscapes and street scenes, portraits, and architecture : and then it has to be explained that portraits and architecture, at least with all but a very limited number of subjects, are not best dealt with by snapshotting ; and that architectural work with only a finder as a guide instead of a full-sized focussing screen is difficult enough. We can neither arrange nor focus the picture as we should be able to do.

High-speed work, as a class, is quite outside the powers of the novice. It is a mistake to suppose that to succeed in snapshotting rapidly-moving objects, all that is required is a high-speed outfit; and that because the shutter is graduated to a thousandth of a second, the lens working at, say, f/4, and the plates are of the fastest, such work can be done without experience. The high-speed work reproduced in the daily papers must not be taken as a measure of what is possible under ordinary conditions. Not only is this the work of very expert photographers, but where it is important for the picture to be sharp and clear, a good deal of handwork may be put upon the print before it is reproduced.

Looking through a bundle of beginners' prints, plenty of examples of the impossible type of subject are to be found. I see one of a football match. It has had the advantage of being taken in what seems to have been a very good light, and the distance generally and the more distant of the figures are plainly shown, and that part of the picture is fairly well exposed. But these are mere details, and it is evident that what the photographer was after was a record of the scrimmage going on quite in the foreground. Owing to the large heavy shadows cast by these near objects, the exposure given has been far too short to render the detail properly in this part of the subject: it is a mere black mass, in which one can hardly pick out the form of individual players at all. Yet the exposure was too long to get the rapidly moving figures in this part of the picture quite sharp. Owing to their nearness to the camera, their images moved very rapidly on the plate, and so an exposure was called for of a much shorter duration than the same figures would have required had they been taken from a greater distance. If the photographer aimed at a general view, with the scrimmage a mere item in it, he might have got a sharp and properly exposed result with the outfit with which he was provided, by going further away; but for figures on a large scale and near the camera, it was probably quite unsuitable.

In fact, the hand camera, whatever its type and however well-fitted for ultra-rapid work, should only be used by the beginner for easy, slow-moving, or stationary subjects. There are plenty of these of great interest to be found, and they allow the photographer who is new to the pursuit to concentrate all his attention on the more elementary difficulties and so to learn how to overcome those before passing on to work which takes all the knowledge and ability of the experienced worker to give a successful result.

Work that calls for special materials of any kind should be left until the simpler tasks that can be undertaken with an all-round equipment have been accomplished. For instance, there are some subjects that require a panchromatic plate and a light filter. These plates are a most valuable photographic material, and in the hands of those who know how to use them will give results that cannot be obtained in any other way. But they call for very careful handling. They are most easily fogged, and are really out of the scope of the beginner. In the same way, a colour screen is not an appliance to be used until the photographer is quite *au fait* with photography without a screen. In other words, anyone who has just taken up the use of the camera has no business to be bothering himself with problems of colour rendering, which involve the use of panchromatic plates and light filters, before he has mastered elementary photographic procedure.

I am not at all sure that fast plates of the ordinary kind are the most satisfactory material for the beginner. Each of the leading makes can be obtained of " ordinary " or " landscape " rapidity ; and if, as I strongly urge, the camera is used at first on a stand or support of some kind, and a time exposure is given, it is just as easy to give, say, two seconds exposure with a plate of this kind, as a quarter or a half second with a very fast plate. The ordinary plate is much less likely to be fogged in the dark room, and is more likely, also, to yield a clean bright negative with plenty of vigour. By its use the beginner can learn the important processes of exposure and development much more quickly, and he is far more likely to get encouraging successes from the very beginning of his photographic career. He will also get a higher standard of what a good negative should look like. But this is a counsel of perfection I am afraid.

There are other subjects out of reach of the beginner besides those that call for colour-sensitive plates or high-speed shutters—firelight effects, for example. There have been some clever and successful firelight pictures produced by photography ; but they are exceptional and require a familiarity with apparatus and material such as the beginner does not possess. Even the experienced worker has to encounter many failures in this direction for a comparatively few successes, so that these also should be left unattempted at first. Telephoto work is a branch to which this caution applies, and night photography is another.

Passing from subjects to processes, the same general rule applies. In negative making, one should stick to plain straightforward development and fixing, until they are found to yield good negatives, leaving the various methods of intensification and reduction untouched. The idea that such methods do more than botch up an imperfect result into something not quite so bad is a mistake, and they also have to be learnt before they can be used to advantage. The processes learned at first should be those of exposure and development.

In printing, in the same way, one should take some fairly easy process—gaslight paper, for instance— and stick to that until one is perfectly familiar with it. Only when that is the case should other methods be attempted.

The point of this advice is that we should make haste slowly. There is nothing referred to in it that I have not known beginners to undertake when they had not mastered the most elementary stages in photography. I have been asked to point out what was amiss with a number of carbon prints by a photographer who found that he could not hit upon a sensitizing bath of the right strength to give him good results. Suspecting what was wrong, I asked to see the negatives: they were so imperfect that they would not even yield presentable gaslight prints. All unwittingly he had allowed himself to be led away into the attractive but unfamiliar path of carbon work before he had succeeded in what must necessarily precede it, namely, good negative making.

To avoid disappointment, then, let the beginner at first be quite sure that what he is attempting is within the scope both of his outfit and his attainments. However simple the one and slight the other, they are sure to be sufficient for a great deal of interesting photography, which will yield him the pleasure that is to be derived from successful accomplishment, right from the very first.

INDEX

A

Achromatic lenses, 37, 39
Acid fixing bath, 132
Adhesives for mounting, 151
Amidol developer, 211, 220
Amidol for hot climates, 211
Anastigmat lenses, 36, 40
Angle included by a lens, 26
Antinous shutter release, 90
Apparatus, The care of, 233
Architecture, Distortion in, 39
Arrangement of the subject, 86
Axis of a lens, 25
Azol, 226

B

Backed plates, 60
Backgrounds for portraits, 180
Backgrounds for still-life, 201
Back of the camera, 45
" Bee " meters, 98
Binding lantern slides, 229
Bleachers for sulphide toning, 175
Blistering, 210
Body colour, 169
Bottles, To clean, 241
British Photographic Manufacturers' Association, 7
Bromide paper, 217
Bromide, Stock solution of, 171
Brushes for spotting, 156
Button, Pressing the, 90

C

Camera, The, 42
Camera, The care of the, 233
Camera Cases, 49
Camera, Choice of a, 243
Camera extension, 24
Camera, Fixed-focus, 30, 66
Camera levels, 89
Camera obscura, 43
Cameras for landscape, 195
Cameras, Hand-or-stand, 42
Cameras, Roll-film, 5, 43, 45
Changing plates and films, 62
Chemical dust, 241
Cleanliness, 239
Collodio-chloride paper, 137
Colour screens, 59, 197
Convertible lenses, 37
Copying, 189
Cost of materials, 7
Cross front, 44
Cutting, Guides for, 148
Cutting masks, 159

D

Dark room, 50
Dark room lanterns, 51
Dark slides, Register of, 77
Daylight enlargers, 216
Defective negatives, 165
Depth of focus, 29
Developer, Choice of, 107

Developer for gaslight paper, 129
Developer stains, 134
Developers, To make up, 171
Developing away from home, 203
Developing enlargements, 221
Developing lantern slides, 228
Developing negatives, 104
Development in copying, 193
Development, Time, 105
Dishes, 52, 221, 239
Distances, Estimating, 81
Distortion with lenses, 39
Draining and drying negatives, 116
Dry mounting, 153
Dust, Chemical, 241

E

Enlarging, 215
Enlarging apparatus, 216
Enlarging on bromide paper, 217
Enlarging on gaslight paper, 218
Estimating distances, 81
Exposed plates, To repack, 215
Exposing, 90
Exposing enlargements, 220
Exposing landscapes, 197
Exposing lantern plates, 227
Exposing portraits, 185
Exposing with magnifiers, 73
Exposure meters, 49, 98
Exposures in copying, 192
Exposure tables, 49
Extension, Camera, 24, 46, 77
Extension, Exposure and, 17

F

Film, Loading roll, 61
Film Packs, 5, 8
Films or plates, 5
Finders for landscape work, 195
F/ numbers, 34
Fixed-focus cameras, 23, 66
Fixing enlargements, 223
Fixing negatives, 112
Fixing prints, 132, 140
Focal length, 22
Focus, Depth of, 29
Focussing, 13, 76
Focussing by scale, 68, 82
Focussing jackets, 84
Focussing on the screen, 77
Frilling, 210
Fronts, Rising and cross, 44

G

Gaslight paper, 54, 120, 122
Gaslight paper, Developing, 129
Gaslight paper, Exposures with, 125
Gaslight paper, Grades of, 121
Gelatino-chloride paper, 137
Glossy prints, 135
Groups, 206
Guillotine print-trimmers, 146, 150

H

Handling sensitive materials, 123
Hand-or-stand cameras, 42
Handwork, 167
Hardening baths, 211
High-speed work, 243
Holiday photography, 203
Home portraiture, 179
Hot weather troubles, 209
Hypo, 53, 112

I

Illumination in copying, 191
Illumination of the dark room, 50
Illumination of the subject, 87
Images formed by pinholes, 10
Indoor subjects, 181, 200
Infinity catch, 84
Infinity point, 68
Isochromatic plates, 55, 58

K

Knives for print trimming, 148

L

Landscape, 195
Landscape lenses, 37, 40
Landscape plates, 55
Lanterns, Dark room, 51
Lantern slide making, 225
Latitude in exposure, 94
Lens, Axis of, 25
Lenses, Care of, 234
Lenses, Choice of, 40
Lenses, positive and negative, 21
Lenses, Varieties of, 15, 21, 31
Light filters, 59
Lighting still-life subjects, 201
Loading dark slides, 51

M

Magnifiers, 31, 66, 70
Magnifiers, Copying with, 190
Magnifiers, Exposures with, 73
Magnifying glasses, 15
Markings of stops, 34
Masking negatives, 158
Masking slides, 229
Mason's square, 149
Meters, Exposure, 49
Mounting prints, 150
Mounting, Dry, 153
M.Q. developer, Making up, 171

N

Negative lenses, 21
Negatives and positives, 1, 3
Negatives, Developing, 104
Negatives, Fixing, 112
Negatives, Spotting, 155, 165
Negatives, Washing, 114

O

Orthochromatic plates, 55, 58
Over-exposure, To recognize, 112

P

Packing plates, 63, 237
Panchromatic plates, 59
Panoramic subjects, 197
Paste for mounting, 151
Pinhole images, 10
Plates and films, 5
Plates and films, Storage of, 236
Plates, Backed, 60
Plates, Choice of, 55
Plates, Lantern, 226
Plates, Packing, 63, 205
Plates, Panchromatic, 59
Plates, Self-screen, 60
Plate speeds, 55, 56, 98
Pneumatic shutter release, 90
P.O.P., 137
Porcelain dishes, 52

Portrait lenses, 40
Portraiture, 79, 179, 185
Positive lenses, 21
Printing frames, 53
Printing from defective negatives, 168
Printing on gaslight paper, 120
Printing on p.o.p., 138
Printing with a mask, 158
Prints, To squeegee, 135
Print trimming, 142

R

Rapid rectilinear lenses, 37, 40
Reducing solution, 161
Releases for shutters, 90
Repacking exposed plates, 205
Repairing a negative, 165
Retouching, 165, 186
Reversing back, 45
Rising front, 25, 44
Roll-film cameras, 5, 43, 45
Roll-films, Developing, 107
Roll-films, Loading, 61
Roll-films, Repacking, 205
Rytol, 106

S

Safe lights, 51
Scales and weights, 53
Scales, Focussing, 68, 82
Self-screen plates, 55, 60
Self-toning paper, 137
Sensitive materials, To store, 236
Sheaths, To restore rusty, 233
Shutters, 90, 235
Single lenses, 36
Sizes, Standard, 8
Solutions, Stock, 53
Speed lists, 56, 98
Spots, Causes of, 241
Spotting negatives, 155
Spotting prints, 167
Spotting slides, 231
Squeegeeing prints, 135
Stains, 134, 161
Standard sizes of plates and films, 8
Starch paste, To make, 151
Still-life subjects, 200
Stock solutions, 171
Stops, 25, 29, 32, 78, 99, 194
Storing sensitive materials, 236
Street scenes, 207
Subjects, Unsuitable, 244
Sulphide toning, 174
Swing back, 46

T

Table-top photography, 202
Tank development of films, 107
Telephotographic lenses, 40
Time development, 105
Toning, Sulphide, 174
Trimming prints, 142
Tripods, 49, 195

U

Uncorrected lenses, 36
Under exposure, 95, 111

V

Velox paper, 132
Vertical enlargers, 217
Vignetting, 162

W

Washing enlargements, 223
Washing in hot weather, 213
Washing negatives, 114
Washing prints, 135
Watkins meters, 56, 98
Wheeler's separators, 205
Wratten safe-lights, 51

X

Xylonite dishes, 52

Better **PHOTOGRAPHY MADE EASY...**

Selochrome Roll Film has done for the amateur photographer what the discovery of colour-sensitive plates did for the professional. It has made it possible for every film camera user to take pictures approximating to nature's tones. On dull days and in waning light Selochrome is particularly successful.

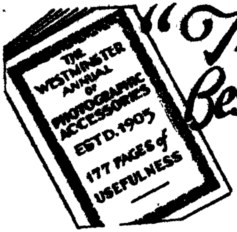
SELOCHROME

Multi-coated *Anti-Halo Backed*

ROLL FILM

¶ **SELO**—An excellent film for everyday snapshotting, very fast, with generous latitude to correct errors in exposure.

Made in England by
ILFORD LIMITED, ILFORD, LONDON



"The Best Photographic Dealers I know"

As a result of our wide experience and the varied stock carried by each of the three Westminster Branches, any photographic requirement can be supplied at the most moderate prices. Expert advice is freely available to all requiring information.

TYPICAL WESTMINSTER OFFERS

Outfits of Similar Outstanding Value Always Available.
Every Type of Apparatus in Stock.

3½ × 2½ ZEISS IKON IDEAL

(As Illustrated)

F/4.5 Zeiss Ikon Dominar Anastigmat, Delayed Action Compur Shutter, Complete Three Slides £7 12 6

¼ PLATE ZEISS IKON MAXIMAR

F/4.5 Zeiss Ikon Dominar Anastigmat, Compur Shutter (NOT ring controlled delayed action type) Complete three slides £5 12 6

These de Luxe Folding Plate Instruments have a full range of movements; rising and cross front, rack focussing double extension; wire frame and reflex finders. All metal body, leather bellows. New and unsoiled. Standard Zeiss Ikon Productions. Offered at practically half price.

WESTMINSTER PUBLICATIONS

WESTMINSTER *Lists are unique.* They cover the whole range of Photography, ordinary and ciné. Particulars of all the latest introductions in New Apparatus and Accessories are included. They also give detailed specifications of the enormous range of guaranteed Second-hand Apparatus available at the Westminster Branches. No other dealer publishes such comprehensive catalogues.

Any or all lists, Free and Post Free upon request. Please state apparatus or accessories in which you are interested.

HIRE PURCHASE

Nine Equal Monthly Payments.

THE WESTMINSTER finance their own transactions and do not pass them on to a finance house for collection. Add 1/- in every 20/- to cash price and divide into nine equal monthly payments. Proposal form on request.

THE WESTMINSTER ANNUAL

O

AC

The Westminster Annual of Accessories gives particulars and prices of all photographic accessories.

175 pages Profusely illustrated

SECTIONAL LISTS OF NEW AND SECOND-HAND APPARATUS

Section A—Roll-film Cameras
„ B—Folding Plate & Film-pack Cameras
Section C—Reflex & Focal-plane Cameras.
„ D—Field & Studio Cameras, Lenses, etc.
„ E—Stereoscopic Cameras & Enlargers.

THE WESTMINSTER

PHOTOGRAPHIC EXCHANGE LIMITED - LONDON
62, Piccadilly, W.1. — 119, Victoria St., S.W.1.
111, Oxford St., W.1.

Aids to Better Photography

● THE 'WELLCOME'
EXPOSURE CALCULATOR
HANDBOOK AND DIARY

A fund of information for "Still" and Ciné worker

Price 1/6, of all dealers

● TRADE MARK 'TABLOID' BRAND
PHOTOGRAPHIC CHEMICALS

Examples: 'Tabloid' Brand 'Rytol' and 'Tancol' and other Developers, 'Tabloid' Intensifiers, Reducers, Desensitiser, Toners, Chemicals for Colour Photography, etc.

Descriptive literature post free from

BURROUGHS WELLCOME & CO.
55, SNOW HILL BUILDINGS
LONDON, E.C. 1

Pho. 1504 COPYRIGHT

PHOTOGRAMS OF THE YEAR

THE ANNUAL REVIEW OF THE WORLD'S PICTORIAL PHOTOGRAPHIC WORK

Edited by F. J. MORTIMER, F.R.P.S.
Editor of "The Amateur Photographer & Cinematographer"

Published Annually in December.

Paper Covers 5/- net.
Cloth Boards 7/6 net.
By post 6d. extra.

Contains excellent reproductions of the most striking pictures selected from the various Exhibitions, and provides the keen amateur with the opportunity of examining at leisure the work of the world's leading artists.

From leading Booksellers or direct from the Publishers

ILIFFE & SONS LTD. DORSET HOUSE, TUDOR STREET, LONDON, E.C.4

"VERICHROME" film

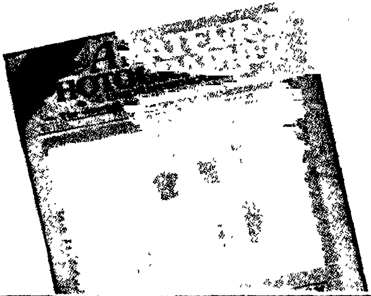
assures better pictures

The reasons for "Verichrome's" superiority are easily understood. It is *Double Coated.* The first coating, a slow emulsion, holds the highlights; the second, a fast emulsion, catches the shadows. The combination results in high speed and enormous latitude. It has an *Anti - Halation Backing* (which disappears during development). It is *fully Orthochromatic*, highly sensitive to the Green and Yellow bands of the Spectrum.

The faster film — the master film—by Kodak

The qualities of Uniformity and Dependability that distinguish all Kodak products ensure your satisfaction with every roll of "Verichrome."

KODAK LTD., KODAK HOUSE, KINGSWAY, LONDON,
W.C.2



HELPS YOU TO GET BETTER RESULTS

"The Amateur Photographer" is a pleasant incentive to improvement in the art of photography. It provides the best examples to follow in style and subject matter, explains in detail the methods and processes which are successful, takes particular pains with its criticism of work done by readers, and arranges frequent competitions for beginners and for advanced workers.

The AMA
PHOTOGRAPHER
& CINEMATOGRAPHER

The Journal for Everybody with a Camera

EVERY WEDNESDAY 3d.

Subscriptions: Home & Canada 17s. 4d.;
Other countries abroad, 19s. 6d.
per annum, post free.

ILIFFE & SONS LTD., DORSET HOUSE, TUDOR ST. LONDON, E.C.4

Look at your Snaps—

Are they the replica of what you saw? Have they that brilliancy, that gradation, which you have a right to expect? Are they, in short, what you *wanted?*

Agfa Films—whether ORTHO, ISOCHROM, or the amazingly rapid SUPERPAN, make light of dull days—give you perfect results under all conditions.

Agfa

Photography Made Easy!

AGFA LTD. 1-4 Lawrence Street, High Street, W.C.2

BOOKS on PHOTOGRAPHY

issued in conjuction with "THE AMATEUR PHOTOGRAPHER"

MOTION PICTURES WITH THE BABY CINÉ. By Harold B. Abbot (Third Edition)

This book has been specially written for amateur cinematographers, and covers all the various aspects of this new and fascinating hobby.

Price 2/6 net. By post 2/8

HAND CAMERAS. By R. Child Bayley (Third Edition)

The standard handbook for the snapshotter who is keen to get the highest proportion of successes among his exposures.

Price 3/- net. By post 3/3

PHOTOGRAPHIC ENLARGING. By R. Child Bayley (Fourth Edition)

This excellently illustrated handbook shows what a simple process enlarging really is, and what interest it provides for the amateur.

Price 3/- net. By post 3/3

WALLS' DICTIONARY OF PHOTOGRAPHY and Reference Book for Amateur and Professional Photographers (Twelfth Edition). Edited and largely re-written by F. J. Mortimer, F.R.P.S.

The Dictionary, apart from its great value as an explanatory index to photographic terms, formulæ etc., may be said to embody a complete series of epitomised handbooks on photographic subjects.

Price 7/6 net. By post 8/-

From all leading Booksellers
or direct from the Publishers

ILIFFE & SONS LIMITED
Dorset House, Tudor Street, London, E.C.4

For Correct Developing use—

The Correct Developer

The AZOL method is not only simple, it is sure. The AZOL Time and Temperature Tables show at a glance just how long to leave the film or plate in the solution to be correctly developed. The AZOL way saves time and money and is most fascinating. A 3-oz. bottle makes 75 to 300 oz. - - - **Price 2/-.**

9d.

On receipt of a 9d. Postal Order we will send a 1-oz. Sample Bottle of AZOL post free.

JOHNSON & SONS,

Manufacturing Chemists, Ltd.

HENDON, LONDON, N.W.4.

EVERYTHING FOR PHOTOGRAPHY

The Firm with 77 years' experience. Send for Lists.

Jonathan Fallowfield Limited

THE SENIOR PHOTOGRAPHIC STORES,
61-62 NEWMAN STREET,
LONDON, W.1.